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[Bogdanov-Kat'kov (N. N.) & Dunin (M. S.).] **Богданов-Катьков (Н. Н.) и Дунин (М. С.). Ed. Diseases and Pests of Chufa** *Cyperus esculentus* **L.** [*In Russian.*]—*Trans. Inst. Grain Legum. Crops Res.* **6** no. 2, 144 pp., illus. Moscow, 1935. (With Summaries in English.) Price 2 *rub.* 50 *kop.* [Recd. 1936.]

This is a collection of papers by various authors, giving the results of investigations on the diseases and pests of chufa (*Cyperus esculentus*) in the Russian Union.

An introductory paper, entitled General Survey of Insects injurious to Chufa in the USSR, by N. N. Bogdanov-Kat'kov (pp. 5-8), includes a list of pests observed in the Russian Union, of which 48 are insects, and more than half of these Coleoptera. None of them is specific to chufa, and only 20 species are at all limited as to food-plants. The most serious pests are those that attack the tubers, not only during growth, but also during storage.

The second paper, Insects injurious to Chufa in the northern Caucasus in 1933 and their economic Importance, by N. S. Turaev (pp. 9–46), includes information on pests not only of the tubers, but also of the leaves and stems, which had previously been considered as not injured by insects. Chufa was attacked by different pests in different stages of its growth. In the period up to sprouting, the sown tubers were attacked by ants, which decreased their sprouting by 1·6 per cent. Other pests, including *Gryllotalpa gryllotalpa*, L., and *Anisoplia segetum*, Hbst., were not of economic importance. In the period from sprouting to tuber development, the shoots were infested by larvae of *Chaetocnema hortensis*, Geoffr., and *C. aridula*, Gyll., which bored into them as soon as they appeared above the soil. The number of infested shoots varied from 29·6 to 49·1 per cent., while the average percentage of injured plants was 55·5, with 16 per cent. total loss of shoots. Early sowings were less infested than late ones, and the plants were not killed, but sprouted again. The yield, however, was reduced; the total loss from heavy infestation is estimated to be 16 per cent. Other pests at this stage were *Phyllotreta vittula*, Redt., *Loxostege sticticalis*, L., and *Lecanium* sp. In the third period, from tuber formation till harvest, pests of economic importance included Lamellicorn larvae (*A. segetum*, *A. austriaca*, Hbst., *Serica* sp., and *Amphimallus solstitialis*, L.), the Elaterids, *Corymbites* (*Selatosomus*) *latus*, F., and *Agriotes gurgistanus*, Fald., the Cistellid, *Podonta daghestanica*, Reitt., Halticids of the genus *Phyllotreta*, and *Euxoa segetum*, Schiff. Their effect was to reduce the yield of tubers by 4 per cent. and to render only 61 per cent. fit for sowing.

The third paper, entitled Insects injurious to Chufa in western Georgia, by T. L. Kudryavtzeva (pp. 47–55), includes notes on several pests, some of which have been mentioned above. The most important was *G. gryllotalpa*, which attacks the roots, tubers and leaves. The Tortricid, *Bactra lanceolana*, Hb., which infested the tubers during growth and storage, is also of economic importance.

In Influence of Time of Sowing on Injuries to Chufa by *Chaetocnema* and some Data on other Pests of Chufa (pp 56–59), Turaev tabulates the results of investigations in western Georgia in 1933 showing that early sowings are much less injured by *C. hortensis* and *C. aridula* than late ones. Up to 8 per cent. of the plants were also infested by *Cosmopteryx scribaiella*, Zell.

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In Enemies of Chufa in the Ukraine in 1933 (pp. 60–73), M. I. Shevchenko notes two periods of infestation of chufa. The first is in the spring up to the time of sprouting, in which the principal insect pests were ants, which destroyed about 7 per cent. of the sown tubers, and the second was in the summer and autumn, from tuber formation to harvest, during which period the greatest damage was caused by larvae of *Melolontha* sp. and *Euxoa segetum*.

In Studies of the Enemies of Chufa during Storage and their Control (pp. 75–98), Turaev discusses the storage of the tubers and the measures to be taken for their preservation from pests. They are infested by a number of the commoner grain pests and by the larvae of *Bactra lanceolana*. Control measures include general storage hygiene and ventilation, with an atmospheric humidity of not more than 11–13 per cent., and fumigation. Tubers may be exposed to carbon bisulphide at a concentration of 1 fl. oz. per 10 cu. ft. for 48 hours, but the concentration must not exceed 2 fl. oz. Carbon tetrachloride at the rate of 2 oz. per 10 cu. ft. had no effect on the germinating power of the tubers, and may be used at rates of up to 7 oz. per 10 cu. ft. Chloropicrin is toxic to the tubers, but may be used to fumigate storerooms. Carbon dioxide, which is slightly toxic to tubers, may be used at concentrations of 60–90 per cent. to control adults of *Tribolium confusum*, Duv., and larvae of *Ephestia kuehniella*, Zell., with 72 hours exposure, and at concentrations of 75–90 per cent. gives 100 per cent. control of *Calandra granaria*, L. in 96 hours. As the tubers are comparatively resistant to high temperatures, *B. lanceolana* and other storage pests may be destroyed by superheating. Complete control was obtained in 15 minutes at 50–55°C. [122–131°F.] and 30–60 per cent. humidity, and in 1 hour at the same temperature and 70–80 per cent. humidity. Lethal temperatures may also be developed by the action of ultra-short waves in an electric field, but germinating power is lost if these exceed 46–50°C. [114·8–122°F.].

[Kirichenko (O. M.).] **Кириченко (О. М.). The Resistance of the Varieties of Wheat to Injuries by Frit-fly (*Oscinella frit* L.) in the South Ukrainian Steppe.** [*In Ukrainian.*]—*Proc. Plant Breed. Genet. Inst.* **1** pp. 34–77, 2 graphs, 6 pp. refs. Odessa, 1935. (With a Summary in English.) [Recd. 1936.]

Oscinella frit, L., is a common pest of cereals in southern Ukraine, and is most abundant in damp years with moderate temperatures following a warm autumn and mild winter. The adults of the overwintered generation appear in the second half of April at 14–16°C. [57·2–60·8°F.] and increase in numbers as the temperature rises. They oviposit when the early-sown summer wheat is tillering. The adults of the first generation are on the wing in June, their appearance coinciding with the flowering and the phase of milky ripeness of wheat and barley, and the eggs are laid on the ears. The flight of the adults of the second generation begins at the end of August, and its duration depends on the meteorological conditions in the second half of September. Oviposition occurs on autumn-sown crops, at a mean day temperature of 16–20°C. [60·8–68°F.]. As the flies are positively phototropic, more eggs are laid in crops that are not very dense. All hard varieties of summer wheat are infested to an approximately equal degree, but in soft varieties the severity of infestation varies greatly. In the case of autumn-sown wheat, however, all

varieties are equally attacked. Mass oviposition occurs on the parts of the plant that are close to the ground, and most of the eggs are laid where they are sheltered. Thus, in the period preceding tillering, they are laid behind the coleoptile, during tillering also behind the prophyllum, and, as the latter dries up, behind the ligule and in the space between the stems. The different varieties of wheat were infested with the larvae and pupae in the same degree as they were infested with eggs. The causes that determine the choice of a plant for oviposition have not been ascertained ; the anatomical and morphological peculiarities of the varieties were not apparently concerned.

[Pyatnitzkiĭ (G. K.).] **Пятницкий (Г. К.). Factors causing and controlling a Mass Increase of Gipsy Moth in Crimea.** [*In Russian.*] —*Probl. Ecol. Biocenology* pp. 100-119, 3 graphs, 10 refs. Leningrad, 1935. (With a Summary in English.) [Recd. 1937.]

The gipsy moth [*Porthetria dispar*, L.] is a serious forest pest in the Crimea, and an outbreak that began in 1929 was severe in 1931 over an area of about 400 sq. miles [*cf. R.A.E.*, A **23** 434]. Investigations showed that the factors that have led to the increase in numbers of the moth, apart from the dry and warm climate, are the predominance in the forests of species of trees that are especially preferred by the larvae (oak, *Carpinus* and beech), and the fact that large areas have been felled and are now covered with young trees or shrubs and exposed to the sun. The infestation usually begins on the southern slopes of mountains in stands of oak and *Carpinus* that are not dense and in which the air and soil are dry and the period of vegetation begins early. It rapidly spreads, chiefly owing to the wind, which carries the young larvae over large distances, and also owing to migration of the older larvae in search of food or shelter for pupation. The migrating larvae invariably move down the slopes and the distance covered by them does not exceed 1,100 yards. Infestation does not occur at altitudes above 2,000 ft. on northern slopes or 2,600 ft. on southern ones, as the temperature there is too low. Under favourable conditions, the females lay a mean of 350 eggs and deposit them in places sheltered from predators and parasites, such as forest litter, cracks in the bark, tree holes, etc.

The peak of an outbreak usually occurs in the second or third year, and is characterised by the presence of large overcrowded foci of infestation, which soon begin to decrease, as, owing to lack of food, the larvae migrate to form new foci in narrow strips round the original ones. About 98 per cent. of those that migrate, however, die before they reach the uninfested area, and most of those that remain in the old foci are killed by disease or starvation. Furthermore, the fertility of the surviving moths is reduced, a mean of only 55 eggs being laid by a female. In 1931, the outbreak was also greatly reduced by the Tachinid, *Sturmia scutellata*, R.-D., which chiefly occurred at the edges of the foci of infestation, probably because the trees there were less defoliated, as it oviposits on the leaves. The percentage of parasitism increased in proportion to the age of the foci, 90–95 per cent. of the larvae being parasitised at the edges of a focus that had been infested for 3 years, as compared with only 0·5–1 per cent. in newly formed foci. The rate of parasitism was considerably higher among the female larvae and pupae, since it is chiefly the female larvae that migrate, as they require a longer period to complete development.

Predators observed were *Calosoma sycophanta*, L., which attacked the larvae, pupae and ovipositing moths, *Picomerus conformis*, H.-S., which attacked the larvae and pupae, and a species of *Dermestes*, which in some places destroyed all the eggs. From 2 to 23 per cent. of the larvae died from flacherie.

The control of *P. dispar* in the Crimea depends chiefly on improved forestry. Felling should be so arranged that the canopy is preserved, trees that are but little attacked by the larvae, such as ash or pine, should be introduced, and seedlings in the felled areas should be protected from cattle.

ANDRÉ (Marc). **Sur le *Pediculoides ventricosus* Newport (Acarien).**—*Bull. Mus. nat. Hist. nat.* (2) **8** nos. 3–4 pp. 240-245, 337-341, 5 figs., 12 refs. Paris, May-June 1936. [Recd. December 1936.]

This paper on the morphology of *Pediculoides ventricosus*, Newp., includes descriptions of the adult female both before and after mating, especially the buccal organs, and of the male, with notes on parthenogenesis and the bionomics of the species [*cf. R.A.E.*, A **14** 564].

WILLIAMS (C. B.). **The Influence of Moonlight on the Activity of certain nocturnal Insects, particularly of the Family Noctuidae, as indicated by a Light Trap.**—*Philos. Trans.* (B) **226** no. 537 pp. 357–389, 7 figs., 12 refs. London, October 1936.

The following is based on the author's summary: The object of the investigation here described was to determine whether the night activity of certain groups of insects, particularly Lepidoptera, is reduced at full moon. A light-trap was placed in a field at Rothamsted in March 1933, and has been in continuous use since that time. The captures of Noctuids during the summers of 1933, 1934 and 1935 were selected for special study. Three main methods of analysis, which are described in detail, were used; all three gave definite indication of lunar periodicity in the Noctuids. The first showed 17 of the 18 lunar months with a higher catch at no moon than at full moon, and a mean difference of 6 times the standard deviation. The third showed a ratio of 3 : 1 between no moon and full moon week captures when the sky was clear, and 2 : 1 when the sky was cloudy. The same method showed that the ratio of captures on cloudy nights to clear nights is about 1·75 : 1, but this is associated with warmer conditions on cloudy nights (about 4°F. higher on minimum temperature) due to the reduction of radiation by the clouds.

Other groups of insects showed varying lunar effects, which were never so marked as that in the Noctuids. The groups that showed least effect were those that fly chiefly at dusk or dawn, whereas the Noctuids have their maximum activity at midnight; but a separate analysis of all insects, according to the different times of the night at which they were caught, showed that this time of flight was not sufficient to account entirely for the difference found.

It is thought that the lunar effect on the catches is definitely demonstrated, and that there is distinct evidence that it differs in different groups, apart from any difference in their time of flight. Therefore it is probably a physiological effect on the activity of the insects and not merely due to reduction in the efficiency of the light-trap when the moon is shining.

MANSBRIDGE (G. H.). **A Note on the Resistance to prolonged Cold of some Insect Pests of Stored Products.**—*Proc. R. ent. Soc. Lond.* (A) **11** pt. 6–12 pp. 83–86, 2 graphs, 1 ref. London, 15th December 1936.

During the winters of 1934–35 and 1935–36, cultures of various insect pests of stored products were exposed in an unheated building where conditions were comparable to those of a warehouse during an English winter. In 1934–35 the temperature in the building did not fall to 0°C. [32°F.], but in 1935–36 it did so on 11 days during three separate weeks, including 2 days continuously below 0°C. at the end of December, and fell to −2°C. [28·4°F.] on two occasions. Under natural conditions, the insects that survived the second winter were *Ephestia elutella*, Hb., *E. kuehniella*, Zell., *Plodia interpunctella*, Hb., *Borkhausenia pseudospretella*, Stn., *Tineola biselliella*, Humm., *Laemophloeus turcicus*, Grouv., *Anthrenus verbasci*, L., *Dermestes lardarius*, L., *Trogoderma granarium*, Everts, *T. versicolor*, Creutz., *Gibbium psylloides*, Czemp., *Niptus hololeucus*, Fald., *Ptinus tectus*, Boield., *Tenebrio molitor*, L., and *T. obscurus*, F. *Ephestia cautella*, Wlk., *Sitodrepa panicea*, L., and *Calandra* (*Sitophilus*) *granaria*, L., survived the first winter, but succumbed to the greater cold of the second. The larvae of *L. turcicus* and adults of *D. lardarius* survived the winter, whereas the adults of the former and the larvae of the latter were killed. In contrast to *D. lardarius*, all examples of *D. vulpinus*, F., were killed early in the winter. This difference in resistance in closely related insects is also found in *E. elutella* and *E. cautella*, *C. granaria* and *C. oryzae*, L., and *Oryzaephilus surinamensis*, L., and *O. s. mercator*, Fauv., and is probably related to a difference in geographical distribution, since in each case the insects more resistant to cold are found in the colder regions.

WATZL (O.). **Die kleine Sommerwurzfliege** (*Phytomyza orobanchiae* **Kaltenbach**).—*Neuheiten PflSch.* **29** no. 6 pp. 228–230. Vienna, December 1936.

The Agromyzid, *Phytomyza orobanchiae*, Kalt., has been found in Austria attacking and killing the parasitic plant, *Orobanche minor*. Some characters of the larva, pupa and adult are described.

SCHMIDT (E. W.). **Die schwarze Blattlaus der Zuckerrübe.** [The Black Aphid of Sugar-beet.]—*Dtsch. Zuckerindustr.* **61** p. 43, 1936. (Abstr. in *Neuheiten PflSch.* **29** no. 6 p. 238. Vienna, December 1936.)

The life-cycle of *Aphis* (*Doralis*) *fabae*, Scop., in Germany is described as follows: The fundatrices hatch in spring from the winter eggs on *Euonymus* and give rise to several generations of parthenogenetic apterous and alate females. The latter migrate to poppy, beans, *Chenopodium* and beet, on which parthogenetic reproduction continues. The colonies on *Euonymus* die out in early summer. In autumn, the winged males and gynoparae migrate among their various food-plants and back to *Euonymus*, on which latter the gynoparae produce the sexual females. These mate with the males and lay from 6 to 12 fertile eggs. The eggs hibernate.

MÜLLER (H.). **Drahtwurmbekämpfung auf Zuckerrübenfeldern.** [Wireworm Control in Sugar-beet Fields.]—*Wiener landw. Ztg* **86** p. 39, 1936. (Abstr. in *Neuheiten PflSch.* **29** no. 6 p. 240. Vienna, December 1936.)

Injury to beet by wireworms can be prevented by mixing the beet seed with 10 per cent. of large-grained maize. Both sprout at the same time and the wireworms prefer the maize. The maize seedlings must be uprooted, when up to 4 larvae will be found in or near the seeds.

JANCKE (O.). **Gespinstmotten an Obstbäumen.** [Ermine Moths on Fruit Trees.]—*Mitt. Landw.* **51** pp. 460–462, 7 figs., 1936. (Abstr. in *Neuheiten PflSch.* **29** no. 6 p. 247. Vienna, December 1936.)

Fruit trees in Germany are sometimes so severely defoliated by the larvae of *Hyponomeuta* that they fail to blossom in the following year, as the nutritive substances are used up for the second summer foliage. Repeated defoliation weakens the trees considerably. The behaviour of *H. padellus*, L., on plum and that of *H. padellus malinellus*, Zell., on apple are compared. A winter spray of 8–10 per cent. tar distillate destroys the larvae under their shelters and an arsenical spray kills them if applied when they are beginning to feed on the leaves. Apple trees regularly sprayed against *Cydia pomonella*, L., suffer little from *Hyponomeuta*. If the larvae are already in their webs, contact sprays should be applied at a high pressure, and if they have pupated, the webs must be burnt off. Against the adults, a bait-spray of 3 per cent. sugar solution containing 1 per cent. derris extract and 0·4 per cent. sodium fluoride can be used ; it kills them before they oviposit.

HERFS (A.). **Ueber Wollschädlinge und Wollschutz.** [On Wool Pests and Wool Protection.]—*Anz. Schädlingsk.* **12** no. 12 pp. 137–142, 19 figs. Berlin, December 1936.

A brief survey is given of the moths and Dermestid beetles that attack woollen goods, including some records of infestation by the Dermestids in various parts of the world. The four species concerned in Germany are *Anthrenus verbasci*, L., *A. scrophulariae*, L., *Attagenus pellio*, L., and *A. piceus*, Ol. Sparrows' nests are an important source of household infestation and should be cleared away if the houses are fumigated. Injury by both moths and Dermestids can be prevented by impregnating the wool with Eulan products.

BRANDT (H.). **Ueber Mehrfachbegattung beim Kiefernspanner** (*Bupalus piniarius* **L.**). [On repeated Fecundation in *B. piniarius*.] —*Anz. Schädlingsk.* **12** no. 12 pp. 143–145, 8 refs. Berlin, December 1936.

In forecasting the abundance of an insect pest, it is important to know whether a male can fertilise several females or only one. In laboratory experiments in Germany, it was found that a male of the pine Geometrid, *Bupalus piniarius*, L., can fertilise four females and that about 60 per cent. of the males fertilised at least two. Females representing 80 per cent. of the total population can therefore be rendered reproductive.

Kunike (G.). **Wanzen an Getreide.** [Bugs on Cereals.]—*NachrBl. dtsch. PflSchDienst* **17** no. 1 pp. 1–4, 5 figs. Berlin, January 1937.

The Pentatomids that occur on cereals in Germany are *Eurygaster maura*, L., *E. austriaca*, Schr., *Aelia rostrata*, Boh., *A. acuminata*, L., *Carpocoris pudicus* var. *fuscispinus*, F., and, occasionally, *Dolycoris baccarum*, L., and *Palomena prasina*, L. None of them is specific to cereals, about 99 per cent. or more of the individuals of all species occurring on other plants. In East Prussia, the bugs were found only on weak cereal plants, but this was possibly because these plants were close to the edges of woods. The punctures in wheat seeds by *Eurygaster*, *Aelia* and *Carpocoris* were found to be alike externally. They caused the seeds to shrivel, but did not injure germination [*cf. R.A.E.*, A **23** 120]. The injury to the gluten cells caused by the saliva [*cf.* **23** 119, etc.] is described.

Voelkel (H.) & Klemm (M.). **Die wichtigsten Krankheiten und Schädigungen an Kulturpflanzen im Jahre 1936.** [The chief Diseases of and Injuries to cultivated Plants in 1936.]—*Beil. NachrBl. dtsch. PflSchDienst* **17** no. 1, 22 pp., 4 graphs, 56 maps. Berlin, January 1937.

Records of insect pests from various parts of Germany constitute a large part of this list.

Tiensuu (L.). **Insect Life on Plants attacked by Aphids.**—*Suom. Hyönteistiet. Aikakausk.* **2** no. 4 pp. 161–169, 11 refs. Helsingfors, 1936.

The author records a large number of insects, mostly Diptera, collected in Finland on plants infested with Aphids, on the secretions of which they were apparently feeding.

Vappula (N. A.). *Blastodacna putripennella* **Zell. (Lep., Momphidae), ein für Finnland neuer Apfelbaumschädling.** [*Chrysoclista putripennella*, an Apple Pest new to Finland.].—*Suom. Hyönteistiet. Aikakausk.* **2** no. 4 pp. 180–182, 6 refs. Helsingfors, 1936.

The Tineid, *Chrysoclista* (*Blastodacna*) *putripennella*, Zell., was found for the first time in Finland in the autumn of 1934, the larvae having prepared cavities for hibernation under the bark close beneath the buds of apple. On 27th June 1935, it was observed that the larvae had caused injury to the new leaf and blossom shoots, to which they had evidently migrated in spring. Most of them had pupated in the shoots they had attacked. Adult flight apparently occurs from mid-July to mid-August. A number of parasites emerged in July, including Pteromalids, Encyrtids, a Braconid, and *Pimpla examinator*, F.

Department of Scientific & Industrial Research. Forest Products Research. **A Handbook of Home-grown Timbers.**—Med. 8vo, iv + 47 pp. London, H.M.S.O., 20th January 1937. Price 1*s.* 6*d.*

A general description is given of each of the principal timbers grown in Britain, followed by brief notes on its properties and uses, including

its natural durability, the readiness with which it is penetrated by liquids used for preservative treatment, and its liability to attack by insects.

Dawson (R. B.) & Ferro (R. B.). **Investigations on the Control of Leather Jackets. (1) The Use of Lead Arsenate.**—*J. Bd Greenkeep. Res.* **4** no. 15 pp. 239–261, 9 figs., 1 pl., 2 refs. Bingley, Yorks., 1936.

As considerable damage was caused by Tipulid larvae to golf greens in England and Scotland in the winter of 1934-35, investigations were begun to determine the best methods of applying lead arsenate for their control. The experiments, which were carried out at 3 centres, are described in detail, and the statistical methods employed in their arrangement and in the interpretation of the results are fully discussed. The effectiveness of the different treatments was estimated by applying to the soil a 64 per cent. emulsion of orthodichlorobenzene and Jeyes fluid diluted to 1 : 400, at the rate of 1 gal. per sq. yard, to bring the larvae to the surface. Lead arsenate powder was mixed with a small quantity of carrier and distributed by hand at rates of ½, 1 and 2 oz. per sq. yard ; and a colloidal lead arsenate (containing 50 per cent. moisture) was mixed at the rates of 1 and 1½ pints per gal. water and applied with a watering can at these rates per 25 sq. yards. At two of the centres, there was efficient control with all treatments, and no significant difference between light and heavy rates of application. At the third, similar results were obtained with the first and third counts, 4 and 6½ weeks after treatment, but with the second, 5½ weeks after, the heavier applications were significantly better. The percentage control obtained was approximately 90–98 after 2–3 months ; at one centre it was 70 after 4 weeks. No injury to the turf was observed immediately after treatment or during the ensuing summer.

As a result of these experiments it is recommended that periodical tests with orthodichlorobenzene should be carried out so as to detect an infestation in its early stages. Lead arsenate powder (which is cheaper for a given area than the colloid) should then be applied at the rate of 1 oz. per sq. yard. Applications may be made at any time in the spring, autumn and winter, but preventive treatments should preferably be carried out in November and December. Animals should not be allowed to feed on the treated grass until the lead arsenate has been washed into the soil. Replies to a questionnaire circulated among golf clubs known to have used lead arsenate against Tipulids were in general agreement that it is effective, that the powder is slightly more effective and convenient to handle than the colloidal form, and that no injury is caused to turf.

Balachowsky (A.). **Note préliminaire sur les dégâts occasionnés par *Tettigoniella viridis* L. aux cultures fruitières du marais niortais.**—*C. R. Acad. Agric. Fr.* **22** no. 30 pp. 1057–1064, 4 refs. Paris, December 1936.

Serious damage to fruit trees, bush fruits and ornamental shrubs in Deux-Sèvres has recently been caused by the deep incisions made for oviposition by *Cicadella* (*Tettigoniella*) *viridis*, L., an indigenous Jassid that lives on low growing plants in marshy places and on the banks of streams and has not previously been recorded as a pest in France. Eggs have now been found in the subcortical tissues of

most of the woody trees, including a number of economic importance, a list of which is given. Low branches, 1–3 years old, on the southern and south-western sides of trees were most frequently selected for oviposition, which occurred from mid-September till the end of December and led to the desiccation and death of young shoots and grafts. In 1936, the nymphs hatched during April and the first half of May. Unsuccessful attempts were made to rear them on clover, lucerne and grasses. In the field, the adults appeared about the end of August. They seldom fly, and, as they leave the trees at night to shelter in the surrounding grass, ascending the trees only in the warmth of the day to lay their eggs, it is thought that banding the trunks with an adhesive about 1 ft. above the ground should be an effective method of control. Trees with long smooth trunks in windy situations are the least likely to be attacked.

VAN POETEREN (N.). **Verslag over de werkzaamheden van den Plantenziektenkundigen Dienst in het jaar 1935.** [Report on the Work of the Phytopathological Service in 1935.]—*Versl. PlZiekt. Dienst* no. 83, 88 pp., 6 pls. Wageningen, December 1936.

Many of the pests recorded in Holland in 1935 have been noticed from previous reports [*R.A.E.*, A **23** 717; etc.]. *Trachea secalis*, L. (*Hadena didyma*, Esp.) caused considerable injury to winter wheat, oats and barley, particularly where there had been a delay in ploughing the previous crop in the rotation (lucerne, clover or pasture). Apparently eggs are not deposited in the bare ground, and ploughing about mid-August should prevent attack. Wheat was also seriously infested by *Contarinia tritici*, Kby., and *Sitodiplosis mosellana*, Géh., especially the former, and no adequate control is known as yet. *Ceuthorrhynchus suturalis*, F., injured onion plants 1–3 weeks old, the thin stems bending over at the point gnawed by the adult weevil; no such attack appears to have been recorded in the literature. *Dendroctonus micans*, Kug., which had not previously been recorded in Holland, infested 40-year-old trees of *Picea orientalis* so severely that they had to be felled. Derris dusts gave good results against *Lygaeonematus abietinus*, Christ, and *Diprion* (*Lophyrus*) *pini*, L., serious outbreaks of which occurred on spruce and pine respectively. A Cecidomyiid, *Feltiella tetranychi*, Rübs., and a Calliceratid, *Aphanogmus radialis*, Kieff. (both recorded for the first time from Holland) were reared from rose leaves infested by *Tetranychus telarius*, L. (*Epitetranychus althaeae*, v. Hanst.); it is considered certain that the larvae of *Feltiella* had been attacking the mite and had been parasitised by *Aphanogmus*. *Trialeurodes vaporariorum*, Westw., is becoming increasingly injurious to tomato under glass, but is parasitised by a species of *Encarsia*, which may prove of value in its control.

A list of the insecticides and fungicides tested during the year is given, with notes on the results obtained.

JANCKE (O.) & MAERCKS (H.). **Versuche zur Bekämpfung der Pflaumensägewespen.** [Experiments in the Control of Plum Sawflies.] —*Prakt. Bl. Pflanzenb.* **14** no. 7 pp. 189–198. Freising, October 1936.

In the spring of 1936, laboratory and field experiments were made in the Rhine Palatinate to test the possibility of destroying the eggs of the plum sawfly [*Hoplocampa minuta*, Christ] in the calyces of

plums by means of a quassia spray. Nicotine and some proprietary contact sprays were also tested. In the field, it was found that an extract of quassia chips (3 lb. to 10 gals.), with or without the addition of 0·25 per cent. soap, gave good results [*cf. R.A.E.*, A **24** 799]. Nicotine at a strength of 0·15 per cent. also proved satisfactory. In the laboratory, encouraging results were obtained also with proprietary sprays containing nicotine, rotenone, or pyrethrum. An extract of quassia was kept for a fortnight until it began to have a putrid odour, and to throw down a flocculent precipitate. It was tested daily against *Aphis* (*Doralis*) *pomi*, DeG., and no decrease in efficiency was observed, so that it would seem that a quassia spray ready for use could be kept for some days if the weather should prevent its immediate application.

Weigert (J.) & Weizel (H.). **Die Abhängigkeit des Halmfliegenbefalls bei Weizen von verschiedenen Anbaumassnahmen.** [The Dependence of the Infestation of Wheat by *Chlorops taeniopus* on various cultural Measures.]—*Prakt. Bl. Pflanzenb.* **14** no. 7 pp. 198–203. Freising, October 1936.

Observations on the occurrence of wheat pests in Bavaria in relation to various cultural measures [*cf. R.A.E.*, A **23** 703] were continued in 1936, when wheat was severely infested by *Chlorops taeniopus*, Mg. The findings of the preceding year were confirmed and amplified. Infestation by *C. taeniopus* is most severe in fields in which growth is slow at the time of sprouting of the ears, so that conditions are favourable for oviposition. It is thus promoted by late sowing, sparse distribution or wide spacing of the plants, the slow growth of varieties unsuited to local conditions, and insufficient manuring, especially with nitrogen.

Aufhammer (G.) & Hofmann (C.). **Wanzenschäden an Getreide.** [Injury to Cereals by Bugs.]—*Prakt. Bl.. Pflanzenb.* **14** no. 9 pp. 253–265, 13 figs., 5 refs. Freising, December 1936.

Injury to wheat in south Germany, resulting in the deterioration of the gluten and the baking quality of the flour, which was increasingly reported during 1934 and 1935, was due to native Pentatomids, among which *Eurygaster maura*, L., predominated. In 1936, when there was much more rain during May-July than in the two preceding years, the damage was only half as severe as in 1935. In the Danube and Amper valleys, wheat and barley with milky seeds were also attacked by *Aelia acuminata*, L., *Dolycoris baccarum*, L., *Carpocoris pudicus*, Poda (*purpureipennis*, DeG.), *C. p. fuscispinus*, F., and *Palomena prasina*, L. The bionomics of *E. maura* were studied at Kelheim in the Danube valley and in the laboratory. The overwintered adults feed, pair and oviposit in spring. The bugs of the new generation become adult during the summer and seek winter quarters in autumn under grass, dried leaves or moss. On 13th July 1936, adults were found together with eggs and nymphs in all five instars. After the wheat has been mown, the bugs migrate from the stubble fields to grasses, on which they feed. Except for a few nymphs in the fourth and fifth instars, all are then adults. In September, both *E. maura* and *A. acuminata* feed on grasses. In the laboratory, *E. maura* was reared to the adult stage on dried green grains soaked for 24 hours. The number of eggs was not ascertained. At an average temperature

of 20°C. [68°F.] and relative humidity of 75 per cent., the egg-stage lasted 13 days and the 5 nymphal instars 10, 14·6, 15·5, 16·2 and 18 days, respectively.

Böttcher (F. K.). **Bienensterben durch Schädlingsbekämpfung?** [Mortality among Bees due to Insecticides and Fungicides.]—*Angew. Chem.* **50** no. 3 pp. 81–84, 18 refs. Berlin, 1937.

Of the insecticides used in Germany, those that contain arsenicals are the most likely to poison honey-bees. Nicotine repels bees, and though some risk is involved in the use of pyrethrum or derris, the former being the more dangerous, both rapidly lose their toxicity and are far less dangerous than arsenicals. Sprays of quassia at customary strengths seem quite harmless to bees, while lime-sulphur apparently repels them. Baits containing sodium fluoride or sodium fluosilicate do not seem to be visited by bees.

Piguet (G. A.). **La teneur en arsenic des produits de vignes traitées aux sels arsenicaux.**—*Landw. Jb. Schweiz* **50** no. 9 pp. 908–950, 3 figs., 113 refs. Berne, 1936.

The first part of this paper comprises a review of the extensive literature on the possible risks of using arsenical insecticides on cultivated plants, and particularly vines. The author concludes that the very small amount of arsenic occurring in the soil as a result is not likely to affect subsequent cultivation in any way. Cases of contamination of drinking water and poisoning of farm animals and game appear always to have been due to negligence [*cf. R.A.E.*, A **24** 757], but with regard to bees the evidence is conflicting. The second part includes a discussion of the findings of various workers with regard to arsenical residues in grapes, wine, etc., and a detailed account of the technique and results of experiments carried out by the author in Switzerland. These showed that, following normal applications of arsenicals, the amount of arsenic (As_2O_3) on the stems and berries and in the lees and must did not exceed 72, 0·8, and 10 mg. per kg. and 1 mg. per litre, respectively. In wine, the mean oscillated between 0·025 and 0·05 mg. per litre. In the third part, legislation on the use of arsenicals in Switzerland is discussed in some detail. Restrictions on their sale and use appear to be sufficient to safeguard public health. Regulations in force in other countries are dealt with more briefly.

Faes (H.). **Station fédérale d'essais viticoles à Lausanne et Domaine de Pully. Rapport annuel 1935.**—*Landw. Jb. Schweiz* **50** no. 10 pp. 1029–1077, 7 figs., 1 graph. Berne, 1936.

Many of the pests recorded in this report were noticed from the previous one [*R.A.E.*, A **23** 735]. *Paratetranychus pilosus*, C. & F., caused serious local damage to vines. Sprays of white oil applied in mid-April to destroy the eggs did not give complete control; in the summer, however, white oil, as well as a spray of nicotine and soap, gave good results, but the latter has better powers of penetration. *Argyresthia conjugella*, Zell., did considerable damage to pears and apples, although its usual food-plant, *Sorbus aucuparia*, fruited abundantly. Arsenicals appeared to be of little value against it.

Nägeli (W.). **Die kleine Fichtenblattwespe** (*Lygaeonematus pini* **Retz.**=*Nematus abietinus* **Christ**). [The small Spruce Sawfly, *Pristiphora abietina*, Christ]—*Mitt. schweiz. Anst. forstl. Versuchsw.* **19** no. 2 pp. 213–381, 16 pls. text-ill., 147 refs. Zürich, 1936. (With a Summary in French.)

The following is largely taken from the author's summary: This paper on the spruce sawfly, *Pristiphora* (*Lygaeonematus*) *abietina*, Christ, gives the results of investigations in Switzerland, especially at Höhragen, a 400-acre forest area near Bülach, where there has been a serious infestation since 1909. To attain a more comprehensive view of its biology, data published in the foreign literature have been considered, particularly those obtained during 30 years in the Naunhof forestry division near Leipzig. The classification and synonymy of *P. abietina* is surveyed, and notes are given on other sawflies of the same genus that infest spruce. These include a new species, *P. stecki*, taken near Bülach, both sexes of which are described. Details are also given of the morphology and anatomy of the adults and larvae of *P. abietina*.

Adult emergence from the cocoon in the ground litter depends essentially on temperature, so that its date varies from year to year and it may be interrupted by a cold spell. In the Swiss plateau, the adults appear in May or early June, the males usually a few days before the females. Pairing was noticed only once. In the laboratory, parthenogenesis, producing male offspring, was common, and the females laid 80–100 eggs each. For oviposition, the spruce shoot must be in a special state of development, which lasts only a few weeks. The bunch of needles must be free from the bud scales, but the individual needles of the young shoot must still form a compact whole. The egg is laid in a slit cut in a needle well protected in the May shoot. The larva hatches in 3–5 days and is ready to spin its cocoon 12–20 days later. If the oviposition period has been prolonged, however, larvae can be found on the trees for up to 5 weeks. The male larvae have four instars, and the females five. The cocoons are spun in the ground litter or in the surface layer of soil and are most abundant under moss or in places with humus, while only few occur in litter from deciduous trees or under brambles. Pupation takes place about a fortnight prior to adult emergence in spring.

The larvae are attacked by various predators, of which those of importance occur in the ground litter, where Coleoptera have been found to destroy up to 90 per cent. of the larvae in their cocoons in winter. The parasites reared from cocoons collected in Switzerland were *Stylocryptus brevis*, Grav., *Polyblastus flavicauda*, Roman, *Microcryptus vestigialis*, Först., *M. brachypterus*, Grav., a species allied to *M. punctifer*, Thoms., that is probably new, one provisionally identified as *M. gravipes*, Grav., *M. puncticollis*, Thoms., *Phygadeuon mixtus*, Bridg., *Phaeogenes* sp., *Ichneutes reunitor*, Nees, *Mesoleius* sp., and *Mesochorus* sp. All but the first five were of occasional occurrence, and the *Mesochorus* is thought to be a hyperparasite.

It was confirmed that infestation by *P. abietina* begins in young plantations and then spreads to older forests. The latter are severely attacked, whatever the condition of the trees, if the soil is such as to favour the cocoon stages. The deformations of the crown caused by infestation may result in the growth of the trunk being reduced by about 70 per cent. Few of the trees are killed even if they are attacked

year after year, and, when the outbreak ends, the crowns recover in a few years. To prevent infestation, spruce should be grown in mixed stands. If this is not possible, trees of rapid growth should be planted. The ground litter is rendered unfavourable for the cocoons if deciduous trees, especially beech, are grown under spruce, or if the spruce crowns are separated, as in the latter case brambles spread rapidly and cover the ground. Derris dusts provide the most suitable method of direct control. Bird protection is advised [*cf. R.A.E.*, A **25** 57], and also the introduction of any parasites that do not occur in the area of an outbreak.

VENTURI (F.). **Contributo alla conoscenza dell'entomofauna del frumento. II.** (*Dizygomyza lateralis* **Macquart**). [A Contribution to the Knowledge of the Insect Fauna of Wheat. II. *Agromyza lateralis*.]—*Boll. Ist. Ent. Bologna* **8** pp. 1–26, 13 figs. Bologna, 1936.

In this paper, which is one of a series [*cf. R.A.E.*, A **22** 564], all stages of *Agromyza* (*Dizygomyza*) *lateralis*, Macq., are described in detail. In Emilia, this leaf miner has 6 generations a year, all of which occur on couch grass (*Agropyrum repens*), and the first two also on wheat. The winter is passed in the pupal stage in the larval mine. The infestation of wheat is negligible in Italy, and, in general, the fly is not abundant, as its numbers are kept down by parasites and by the destruction of the eggs and larvae when the grass is cut for hay. It is only where large areas of grassland are not mown that favourable factors can lead to an increase and injury to wheat such as has occurred in Russia [**20** 150].

VENTURI (F.). **Contributi alla conoscenza dell'entomofauna delle graminacee coltivate e spontanee. III.** [Contributions to the Knowledge of the Insect Fauna of cultivated and wild Graminaceae.]—*Boll. Ist. Ent. Bologna* **8** pp. 141–149. Bologna, 1936.

In this paper, which belongs to the same series as the preceding one, the author records some observations on the biology of 10 species of insects that infest wheat and *Agropyrum repens* near Fano and Bologna, *viz.*: *Lema melanopa*, L., *Phorbia genitalis*, Schnabl, *Agromyza frontosa*, Beck., and *A. mobilis*, Mg., all recorded from wheat; *A.* (*Dizygomyza*) *incisa*, Mg., from wheat and oats; *Tenthredopsis picticeps*, Cam. (*dubia*, Knw.) and *Contarinia venturii*, Vimmer, from wheat and *Agropyrum*; *Hispella atra*, L., from *Agropyrum* and self-sown wheat; and *Ochlodes* (*Augiades*) *sylvanus*, Esp., and *Harmolita* (*Isosoma*) sp. from *Agropyrum* only.

SERVADEI (A.). **Contributi alla conoscenza dei Tentredinidi (Hymenoptera Symphyta) delle rose. III.** *Cladius difformis* (**Panz.**) **Illig.** [Contributions to the Knowledge of Sawflies of Roses. III. *Cladius difformis*.]—*Boll. Ist. Ent. Bologna* **8** pp. 169–196, 17 figs. Bologna, 1936.

Descriptions are given of all stages of *Cladius difformis*, Panz., the larvae of which feed on the leaves of wild and cultivated roses in Italy. In years in which they are abundant enough to attack most of the leaves, the production of flowers is seriously reduced. There are three generations a year in Emilia, the adults occurring in May, July, and

August–September. The eggs are laid in the leaf stalks. The larvae of the first two broods spin their cocoons on the leaves, but those of the third brood make them just below the surface of the soil and pupate in the following spring. The larvae are parasitised by an Ichneumonid, *Mesoleius armillatorius*, Grav., and a Eulophid, *Tetrastichus hylotomarum*, Ratz. ; the former was obtained from the first generation only and the latter from all three. In a foot-note, the author states that, according to Masi, *T. hylotomarum* is probably synonymous with *atrocoeruleus*, Nees, the species described under the latter name by Thomson being distinct. It is the latter species that was recorded from *Arge pagana*, Panz., in the author's previous paper [*R.A.E.*, A **22** 364].

Servadei (A.). **Contributi alla conoscenza dei Tentredinidi (Hymenoptera Symphyta) delle rose. IV.** *Emphytus cinctus* **(L.) Klug.** [Contributions to the Knowledge of Sawflies of Roses. IV. *E. cinctus*.]—*Redia* **22** pp. 97–129, 26 figs., many refs. Florence, 19th December 1936.

Emphytus cinctus, L., all stages of which are described, occurs in Italy on roses, vines, gooseberries and other plants. It has two generations a year on roses in Tuscany and Emilia. The eggs are laid in the leaves, and the larvae feed on the lower leaf-surface and make their cocoons in the pith of the branches, those of the second generation pupating in the following spring. The adults of the overwintered generation are emerging from about 20th March until the end of April. They pair and oviposit in a few days and the eggs hatch in about a week, so that larvae of all ages occur together. First-generation adults have been observed in June and July, second-generation eggs in July and August and larvae from early August to mid-September. A list is given of the parasites recorded from *E. cinctus* in the literature. The author obtained only a species of *Tetrastichus*, which emerged from eggs of the first generation. *E. cinctus* can cause serious injury to roses, not only by defoliation but also because the branches containing the cocoons break or wither.

Ghimpu (V.). **Insectele dăunătoare tutunului depozitat şi combaterea lor.** [Insects injurious to stored Tobacco and their Control.]—*Bul. Cultiv. Ferment. Tutun.* **24** no. 3 pp. 269–293, 11 figs., 17 refs. Bucarest, 1935. (With a Summary in French.) [Recd. 1937.]

Data on the bionomics and control of *Ephestia elutella*, Hb., and *Lasioderma serricorne*, F., in stored tobacco are briefly reviewed from the literature. *E. elutella* has long existed in tobacco stores in Rumania and does considerable harm, especially to the higher grades of leaf. *L. serricorne* was found in consignments of tobacco imported from various countries in 1933 and 1935 ; it is possible that it has often been introduced into Rumania, but has not become established owing to low winter temperatures.

The author has obtained satisfactory results by fumigating tobacco with Zyklon B at the rate of 2 oz. per 100 cu. ft., but, as buyers of Rumanian tobacco are apprehensive of hydrocyanic acid gas, he suggests that the best method is fumigation with ethylene oxide in a partial vacuum, Zyklon B being reserved for empty warehouses.

GHIMPU (V.). **Afecţiunile patologice şi inamicü tutunului in România şi diferite experiente in 1936.** [Diseases and Pests of Tobacco and various Experiments in Rumania in 1936.]—*Bul. Cultiv. Ferment. Tutun.* **25** no. 4 pp. 400–406. Bucarest, 1936. (With a Summary in French.)

The insects observed attacking tobacco in Rumania in 1936 were *Gryllotalpa gryllotalpa*, L., *Forficula auricularia*, L., *Melanotus rufipes*, Hbst., *Dasus* (*Opatrum*) *intermedius*, Fisch., *Euxoa segetum*, Schiff., *Trialeurodes* (*Asterochiton*) *vaporariorum*, Westw., *Myzus persicae*, Sulz., and, especially, *Thrips tabaci*, Lind. A spray containing nicotine sulphate gave very good results against the last two.

[STEPANTZEV (I. N.).] **Степанцев (И. Н.). Seasonal Bicyclicity of Generations of the Spider-mite.** [*In Russian.*]—*Social. Sci. Techn.* **4** no. 6 pp. 60–62, 1 graph. Tashkent, 1936.

[YAKHONTOV (V. V.).] **Яхонтов (В. В.). Note on the foregoing Article by I. N. Stepantzev.**—*T.c.* pp. 62–63.

Observations carried out for 3 consecutive years in eastern Uzbekistan showed that a reduction in the numbers of the red spider [*Tetranychus* sp.] invariably occurs on weeds in May–June, and also on cotton if it has migrated to it by this time. The duration and intensity of the reduction varies in individual years, depending on meteorological conditions. Infestation increases again in July, so that it occurs in two cycles as a result of a rapid succession of generations both before and after the period of reduction. The author believes that the interruption in the increase of the mite is due to a reduction in atmospheric humidity in June. This is especially marked in the cotton fields, as the plants are small and do not protect the soil from loss of moisture by evaporation. Moreover, the mowing of lucerne and the termination of the vegetation of the spring ephemeral weeds also contribute to render the ecological conditions unfavourable to the mite. As the foliage on the cotton develops and forms a canopy, the rate of the evaporation decreases, and by mid-July its intensity is only half of that observed in June, or one-third of that occurring on plots devoid of vegetation. If the rate is very much reduced, however, conditions again become unfavourable to the mite, as the excess of moisture causes a temperature that is too low for it to develop rapidly; in some cases the cotton may even escape infestation.

In the second paper, it is suggested that the conclusion that the numbers of *Tetranychus* decrease in eastern Uzbekistan in May–June and that the degree of infestation of cotton depends on humidity is based on insufficient data. The disappearance of the mite from ephemeral weeds (which are its preferred food-plants) at the end of their vegetation period may be due to its migrating to other weeds, so that it becomes widely dispersed. Such migration has been observed to occur near Tashkent, where the mite has also been found in large numbers on the soil. Moreover, it is at this time that cotton usually becomes infested.

BEDFORD (H. W.). **Entomological Section Agricultural Research Service. Report on Work carried out by the Staff of the Section during the Season 1934–35.**—*Rep. Agric. Res. Serv. Sudan 1935* pp. 63–96, 1 fldg map, 1 fig. Wad Medani [1936].

From 1st April 1935, the Entomological Sections of the Gezira Agricultural Research Service and the Wellcome Tropical Research

Laboratories were both absorbed into the Agricultural Research Service of the Department of Agriculture and Forests.

An account is given of the insect pests occuring in the Anglo-Egyptian Sudan during 1934–35, and of the experimental work carried out on some of them. In at least half of the Provinces, infestation of cotton by *Platyedra gossypiella*, Saund., was more severe than in the previous season [*cf. R.A.E.*, A **23** 635] ; practically all the bolls were affected in one locality in Khartoum Province for a short time at the end of February, and about 75 per cent. in one part of Berber Province during September. The larvae were also found infesting the fruits of *Hibiscus esculentus* and *Corchorus olitorius*. It is probable that a large part of the infestation of cotton each year is due to the storing of seed cotton, cotton sticks and untreated cotton by the natives.

To find the period of emergence of moths from the resting stage, samples, each of 10,000 bolls, were collected on 22nd April and 19th May and placed in separate cages ; maximum emergence from the first sample occurred from 26th July to 1st August, when 155 moths emerged, and from the second sample in the following week, when 50 emerged. In both cases there was a second peak of emergence 4 weeks later.

In the northern parts of the Sudan, infestation of cotton by *Earias insulana*, Boisd., was more severe than in 1934, especially in Berber Province, where it reached 83·8 per cent. in one locality in November, and in Dongola Province, where this was the only bollworm of importance. Damage was also above normal in Khartoum Province, where 17·2 per cent. of the bolls were injured in January. In Berber Province, the following alternative food-plants of *E. insulana* were found ; the bracketed figures show the maximum percentage infestation of the fruits with the month in which it occurred : *Corchorus olitorius* (52 in October), *Abutilon* sp. (39·8 in September), *Hibiscus esculentus* (26·8 in November), *H. sabdariffa* (18·0 in December) and *Sida* sp. (2·0 in October). Excepting *H. sabdariffa*, and with the addition of *H. cannabinus*, these were all attacked in the south of Kordofan Province also. *Diparopsis castanea*, Hmps., was not present in the Gezira or the Tokar delta, and in other districts infestation was insignificant. At one locality in Berber, a progressive decrease in the percentage of the bolls damaged in August–December since 1933 is believed to have been due to flooding immediately after the 1933 season, followed by ploughing, which increased mortality of the resting larvae in the soil, and, more recently, to the earlier cutting of the cotton crop, which reduces the numbers that pass into the resting stage.

In the Gezira, infestation of cotton by *Heliothis armigera*, Hb. (*obsoleta*, F.) was heavier than in the previous season, but bud-shedding was lighter, as only one generation occurred on cotton before migration to *Dolichos lablab*. In other districts, damage was not heavy. Laboratory experiments in the Gezira indicated that the moths from long-cycle pupae emerged at various periods of the year, and that those emerging from June to August could carry the species over from one season to another. Larvae were found throughout August on the weed, *Ipomoea cordofana*, and to a small extent on lucerne (*Medicago sativa*). Two generations were produced on weeds, a third on cotton and a fourth and fifth on *D. lablab*. The maximum larval population on cotton occurred in early October, with a smaller peak in mid-October. Infestations of these food-plants in 1934 and 1935 are compared in a graph. Tests were made on the effect of trap-crops of

different strains of *D. lablab*, including one imported from Poona, the flowering time of which, unlike the ordinary strains, can be regulated by varying the date of sowing. At the Gezira research farm, a field of cotton was surrounded by belts of *D. lablab*, the Poona and ordinary strains in strips. The Poona strain was in full flower at the time when the cotton first became susceptible to infestation by *H. armigera*; and, at the period of greatest attack, 120 sq. yds. of the Poona variety, the Sudan variety and adjacent cotton bore 362, 7 and 64 larvae, respectively. The Poona strain retained its attractiveness longer than the cotton. In another locality, the larval population in a cotton plot with an adjacent trap strip of the Poona variety was 21 per cent. lower than in the control plot. In an experiment in which the bolls and buds from cotton on special plots were stripped every fortnight to a degree corresponding to the shedding associated with *H. armigera* in the previous year, the artificial shedding exceeded the natural on control plots and appeared to cause an important loss of crop on one variety but not on another.

In the north, infestation of cotton by *Bemisia gossypiperda*, Misra & Lamba, was less than normal, but in the east it was heavy, particularly in the Gezira, where, with favourable conditions of rainfall and weed growth, cotton was attacked about a fortnight earlier than in the previous season. Experiments in the laboratory showed that the period from oviposition to emergence of adults varied from 14–23 days in August to 25–41 days in December. Samples of cotton leaves were taken as in 1934 [*cf.* **23** 634], and the data obtained showed that the maximum population was present in September on early cotton and in November on late cotton. The continual dispersal of adults from belts of *D. lablab* to cotton caused a heavier infestation at a later date than in the previous year. Parasites were more abundant, but did not give much control. Single whiteflies, feeding for a period of at least two days on the developing leaves of seedlings of Sakel cotton, were able to transmit leaf-curl. The disease was transmitted experimentally to *Hibiscus cannabinus* and *H. sabdariffa*, but not to *Pavonia hirsuta* or *Abutilon ramosum*. It did not appear in *H. esculentus* grown from seed of severely infected plants. *Hercothrips fumipennis*, Bagn. & Cam., and *H. sudanensis*, Bagn. & Cam., caused little damage to cotton during the year, although some serious defoliation occurred in the Gezira in mid-October. Infestation was greatest on plots that had received nitrogen, and was also favoured by wide spacing of the plants. The peak of infestation by *H. fumipennis* was reached at the end of October, and that by *H. sudanensis* about a month later. *Empoasca libyca*, Berg., was abundant in the north, centre and east of the Sudan during the year. In preliminary observations of the effect of the Jassids on the growth of certain varieties of cotton, they caused no reduction in height or bud production, but damage to the older leaves was noticeable, particularly in the case of American cotton.

Sphenoptera gossypii, Cotes, appears to have caused less damage than usual, although infestation reached the normal 15–20 per cent. It is now certain, from the material examined, that this stem borer is the one mainly responsible for injury to cotton in the Sudan, although it is also attacked there by *S. neglecta*, Klug, *S. kolbei*, Kerr., and *S. devorans*, Obenb. In the Gezira, termites caused very serious losses in localised plots, but otherwise injury by them was lighter than usual; about 5,000 acres of cotton were infested in the Tokar delta in October and early November. Damage was most apparent on

land that had been flooded for several seasons in succession, and hoeing also appeared favourable to termites. Luxuriant growth was less susceptible to attack. Other pests of cotton during the year included *Dysdercus* spp., *Helopeltis* sp., which was first recorded in the Sudan late in 1934, causing serious injury in Mongalla Province, *Podagrica puncticollis*, Wse., *Sylepta derogata*, F., *Laphygma exigua*, Hb., and the tree locust, *Anacridium moestum melanorhodon*, Wlk.

The usual migration of *Locusta migratoria migratorioides*, Rch. & Frm., from the south of the Sudan northwards occurred in June and July, and was followed by another from the west, which spread across Darfur into central Sudan. Damage to *Sorghum* was slight and confined to certain districts in the west. *Sesamia cretica*, Led., caused some injury to *Sorghum* and maize in northern and parts of central Sudan ; in one locality in Kordofan, considerable damage by this borer to *Pennisetum typhoideum* (bulrush millet) was reported, but was not confirmed by an entomologist. Nearly 2,000 eggs of *S. cretica* were collected during February, and 99 per cent. of them were parasitised by *Platytelenomus hylas*, Nixon. In one district where this Scelionid is usually bred and liberated with satisfactory results, no releases were made during the season, and damage by the borer was conspicuous. A campaign for the destruction of *Agonoscelis versicolor*, F., was successfully carried out in May and June, and very little breeding took place during the following rainy season. The bugs were beaten from bushes and trees [*cf.* **17** 657 ; **19** 166] to the ground and swept into trenches, in which they were buried. A spray of 2 per cent. carbolic acid and soap emulsion was applied only to isolated clumps of trees ; it proved more effective, but also more expensive, than a nicotine sulphate and creosote wash previously used. *Contarinia sorghicola*, Coq. [*cf.* **24** 442] damaged *Sorghum* in the Gezira in mid-October and later elsewhere. Resting larvae were found in the heads at the end of December. Other pests attacking *Sorghum* were Lamellicorn larvae, which caused severe losses on the Gezira research farm, and *Tanymecus sparsus*, Fhs.

Phenacoccus (*Pseudococcus*) *hirsutus*, Green, which was first recorded in 1934 from garden plants in Khartoum, has spread in spite of measures to control it. The plants most subject to attack included *Hibiscus* spp., kapok, perennial cottons, *Cassia siamea*, *Morus* spp., *Albizzia lebbek*, *Bauhinia* spp. and *Grevillea robusta*. An attempt was made in Khartoum to destroy all severely infested plants. Other measures of control included pruning, with destruction of the infested shoots ; spraying with oil emulsions after pruning ; burning the infested shoots with a flame-thrower ; destroying ants' nests with calcium cyanide ; and banding the trees against ants. Quarantine measures have been established to prevent further importations of this mealybug or its spread. A Gryllid of the genus *Tridactylus* caused severe damage to seedling plants in Khartoum.

Xylopertha picea, Ol., and *Lyctus africanus*, Lesne, which are widely distributed in the Sudan as pests of seasoned timber, confine their attack to native timber.

Wilkinson (H.). **Report of the Entomological Section.**—*Rep. Dep. Agric. Kenya 1935* **2** pp. 60–70. Nairobi, 1936.

Much of the information in this report of work in Kenya during 1935 has already been noticed [*R.A.E.*, A **24** 111, 219, 240, 284].

A parasite of *Pseudococcus kraunhiae*, Kuw., which was imported from Honolulu, failed to breed in *P. kenyae*, Le P., and although *Schizobremia coffeae*, Barnes, a predatory Cecidomyiid that was received from Bukoba [*cf.* **25** 49], was successfully reared, it breeds so slowly in Kenya that its value is doubtful. Studies on *P. kenyae* in Uganda showed that there *Coffea robusta* is attacked somewhat more freely than *C. arabica*. Although several species of parasites were found, the total parasitism was insufficient to account for the low status of *P. kenyae* as a pest, which is probably due to the climate [*cf.* **25** 194]. Two Coccinellids, *Scymnus luteus*, Sic., and *Hyperaspis* sp., possibly *H. pumila*, Muls., were found feeding on *P. kenyae*, and *Hyperaspis* was taken to Kenya, but failed to breed there. An outbreak of *Ceroplastes destructor*, Newst., on coffee in south central Kenya was not very serious, but was the most severe that has been observed in the Colony, and appeared to be connected with the frequent use of poison bait-sprays for the control of *Antestia*. *C. destructor* was heavily parasitised by *Scutellista cyanea*, Motsch., three consignments of which were dispatched by air mail to Australia, where they were received in good condition [*cf.* **25** 11].

During the year, the effectiveness of hand-picking for the control of *Antestia* on coffee was tested [**24** 111]. In the laboratory, a pyrethrum dust (64·3 per cent. of which passed through a screen with 150 meshes to the inch) produced paralysis in 120 examples of *Antestia* in an average of $3\frac{1}{2}$ minutes with a maximum of $6\frac{3}{4}$, and none of the bugs recovered. These experiments indicate that control can be obtained by dusting infested coffee with finely ground pyrethrum powder at the rate of 4 gm. per tree or 6 lb. per acre of 680 trees [*cf.* **24** 240]. A serious outbreak of *Anthores leuconotus*, Pasc. (white borer) that occurred in April was proved to be due to neglect of control measures, and there was no evidence that it had migrated to the coffee from the surrounding bush. The larvae of *Phloeobius* sp. caused considerable damage to 3 per cent. of young coffee plants in one district.

Not more than 1 per cent. of the maize stalks in certain defined areas of the west of Kenya were infested with *Busseola fusca*, Fuller (stalk borer). The Stalk Borer Regulations, which have been held in abeyance for several years, were again brought into operation ; all the maize in these areas must be planted before 31st May. Maize planted in February and March was more heavily infested than that planted later on the same farms, probably because the destruction of old maize stalks had not been completed by the end of the previous season. The application of Derrisol to heavily infested stalks of maize standing in the field beside dumps of old maize stalks gave complete control. Larvae of *B. fusca* were found on the outer leaves of Napier grass (*Pennisetum purpureum*), but experiments showed that larvae younger than the fourth instar were unable to bore into the stems of this grass. All the larvae died, the younger ones on the leaves within 7 days and the older ones in the stems before pupation. Moths did not oviposit when caged on the grass in the field.

KLEIN (H. Z.). **Citrus Mealy Bugs and Ants on Grapefruits.**—*Hadar* **9** no. 2 pp. 42–43, 4 figs., 4 refs. Jaffa, February 1936. [Recd. 1937].

Pseudococcus citri, Risso, is one of the chief pests of *Citrus* in the coastal plain of Palestine and is distributed over most of the country.

It was found in a fresh locality on fallen grapefruit in 1934 and on fruit on the trees in 1935, and was observed to be fostered by *Crematogaster jehovae*, For. The number of infested fruits on each tree rarely exceeded 10, and they were always situated on the lower and interior parts of the tree. The mealybugs were frequently protected by shelters built by the ant. The latter makes nests under stones, etc., and in tunnels in wood bored by other insects, and sometimes extends these tunnels so that it injures the plant directly. It also nibbles the calyces of fruits on which the mealybugs occur, so that the fruits drop very easily. In the summer of 1935, the injury caused by the ants was as great as that caused by the mealybugs. In early autumn, *P. citri* left the stem end of the fruits where it had occurred previously, and was only found at points where two fruits touched each other, and by harvest (November) it was only found on fallen fruit, and the ants had also disappeared from the trees. No fruits dropped during the autumn.

SUBRAMANIAM (T. V.). **Report of Work done in the Entomological Section for the Year 1934–35.**—*Rep. Mysore agric. Dep. 1934–35* pp. 23–25. Bangalore, 1936.

The systematic release of *Trichogramma minutum*, Riley, against sugar-cane moth borers in Mysore [*cf. R.A.E.*, A **24** 5] resulted in one district in an increase in the crop of about 8 tons of cane per acre. The best control was given by the use of cultural methods [*cf.* **24** 242] in conjunction with the release of parasites. An emulsion of a high-boiling coal-tar distillate was applied to 15 acres of young coffee badly infested by *Xylotrechus quadripes*, Chevr., and about 66 per cent. of the plants were preserved. The shot-hole borer of coffee, *Xyleborus morstatti*, Hag., does not appear to breed from March to June. Infestation of tobacco by *Phthorimaea heliopa*, Lw., may be reduced by splitting open the gall formed on the stem ; the insect is killed and the growth of the plant is not affected. An infestation of mites (*Eriophyes* sp.) on jasmine was controlled by dusting with flowers of sulphur. The weevil, *Cosmopolites sordidus*, Germ., occurred in association with a fungous disease of bananas. The rhizomes of suckers to be planted should be soaked in cold water for 3–4 days to eliminate insects.

DESHPANDE (V. G.). **Miscellaneous Observations on the Biology of Aleurodidae** (*Aleurodes brassicae*).—*J. Bombay nat. Hist. Soc.* **39** no. 1 pp. 190–193, 3 refs. Bombay, December 1936.

Some observations on the bionomics of *Aleurodes brassicae*, Wlk., are recorded. In the laboratory, the females laid 56–68 eggs in batches containing from 3 to 28. The larvae pass through 4 instars. During the first part of the fourth instar some feeding is done, but later the cuticle hardens, internal development begins and no food is taken. It thus appears that the latter part of the fourth instar corresponds to the pupal stage of a holometabolous insect. One female survived in a cage with food for 91 days, but males were always short-lived. The preoviposition period was about 7–10 days, and oviposition was retarded by the cold weather, as the development of the ovaries ceased. Adults with sufficient food were not killed by exposure to

1°C. [33·8°F.] for 15 days. The adults were negatively geotropic and positively phototropic, being attracted more to yellow than to white light.

Jepson (F. P.). **Report on the Work of the Entomological Division.**—*Adm. Rep. Dir. Agric. Ceylon 1935* pp. D47–D53, 4 refs. Colombo, 1936.

Most of the information given in this report on insect pests in Ceylon in 1935 has already been noticed from a summary [*R.A.E.*, A **24** 764]. Rearing experiments on *Stephanoderes hampei*, Ferr., showed that the female selects a ripe or nearly ripe coffee berry, enters it in or near the depression on the free end and lays eggs in the seed. The egg, larval, prepupal and pupal stages lasted about 6, 18, 2, and 5 days, respectively. The preoviposition period varied from 5 to 20 days, and the females laid a total of about 50 eggs at the rate of about 2 a day. Females were more numerous than males ; they have been kept alive in the insectary for 8 weeks.

Dias (S. J. F.). **Report on the Work of the Division of Plant Pest Control.**—*Adm. Rep. Dir. Agric. Ceylon 1935* pp. D60–D66. Colombo, 1936.

An account is given of routine work connected with the declared pests of crops in Ceylon [*cf. R.A.E.*, A **24**, 101] during 1935. Two additional insects have been declared pests, *Stephanoderes hampei*, Ferr., on coffee [*cf.* **24** 764], and *Aularches miliaris*, L. [*cf.* **23** 638], which is a general pest of estate and village crops.

The tea pests were *Xyleborus fornicatus*, Eichh., which was found in 3 fresh localities ; *Homona coffearia*, Nietn., infestation by which has decreased in 9 and increased in 7 districts since 1927 ; and nettle grubs (Limacodids), which were much less prevalent than they had been in 1934. On coconut, *Oryctes rhinoceros*, L., and *Rhynchophorus ferrugineus*, F., were reported from five Divisions, and outbreaks of *Nephantis serinopa*, Meyr., occurred in the Eastern Division, where they were controlled by parasites, and in the North-western Division.

Bananas were attacked by *Cosmopolites sordidus*, Germ., and *Odoiporus longicollis*, Ol., only in the North-western and South-western Divisions.

Dodd [A. P.]. **Host Restriction and Host Preference, more particularly among Cactus Insects.**—*Proc. ent. Soc. Queensland* 13th October 1936, multigraph, pp. 1–7. Brisbane, 1936.

Little is known of the methods by which insects select their food-plants or of the conditions that cause individual species to increase the range of plants they attack. The author discusses the question of food-plant restriction with special reference to cactus insects, in view of the extensive work done on the food-preferences of species that it was proposed to introduce into Australia for the control of prickly-pear (*Opuntia*). From the results of this work, he takes examples to illustrate the fact that, though no known cactus insect is restricted

to one species of cactus, nearly all cactus insects show definite limits of food-plant range. About 150 species of true cactus insects are known, and 75 per cent. of these are included in genera restricted to cactus insects. In South America, *Cactoblastis cactorum*, Berg, attacks all species of prickly-pear within its range of distribution except *O. sulphurea*, which is the main food-plant of a closely related and undescribed species of *Cactoblastis*. Both species attack *O. ficus-indica*. Females of *C. cactorum* never oviposit on plants of *O. tomentosa* that are more than about 3 ft. high, although the larvae can develop quite well on large plants. In general, the true prickly-pear insects do not attack the *Cylindropuntia* section of *Opuntia*.

The food-plants accepted by the insects in feeding tests of the starvation type are discussed, and it is concluded that the factor governing the feeding of a prickly-pear insect on a species of plant new to it is neither botanical relationship nor chemical affinity, but physical similarity. It may be expected to feed on plants of which the general texture corresponds roughly with that of prickly-pear. Partly developed larvae of several species could be transferred from prickly-pear into some such unrelated plant and would develop as though there had been no change in their diet. Fruits of peach and tomato were most liable to attack by cactus insects. In the case of *Ozamia* [*clarefacta*, Dyar], normal adults were obtained when eggs were placed on nearly ripe peaches on the tree. The larval stage was completed more rapidly in the peaches than in the prickly-pear fruit, taking 18 and 24 days, respectively. Newly hatched larvae of *Mimorista* [*flavidissimalis*, Grote] developed successfully on tomatos and French beans, producing normal adults. Oviposition occured on tomatos but not on French beans, and on the former two generations were bred. Peach and tomato thus appear to be perfectly satisfactory food-plants for *Ozamia* and *Mimorista*, respectively, and yet both Pyralids are prevalent in Texas where peaches and tomatos grow freely, but have never been recorded from them.

Some examples of the selective powers of insects other than cactus insects are also given, and in conclusion the author suggests that insects recognise plants for oviposition by means of sight and touch as well as smell. He considers, from his work on the Cactaceae, that the probability of restricted feeders extending their range of food-plants is greater than is generally supposed.

The Control of Silverfish ; the Oriental Peach Moth in the Goulburn Valley (Vic.).—*J. Coun. sci. industr. Res. Aust.* **9** no. 4 pp. 319–321. Melbourne, November 1936.

The most troublesome of the silverfish that occur in houses in Australia [*cf. R.A.E.*, A **22** 446] is *Ctenolepisma longicaudata*, Esch., and extensive experiments have shown that it will not feed on baits of arsenic and flour paste, which are commonly recommended for the control of *Lepisma saccharina*, L., in other countries, because the arsenic is repellent to it. Tests were made with 25 other poisons, and barium fluosilicate [*cf.* **24** 378] and zinc borate were found to be the most effective. To prepare the bait, a paste is made of 1 oz. flour, $1\frac{1}{2}$ oz. sugar and 10 oz. water, and, while it is still warm, $\frac{1}{4}$ oz. barium fluosilicate or $\frac{1}{8}$ oz. zinc borate is added. It is then spread on white cards and allowed to dry. Rooms that are severely infested should be thoroughly sprayed with a commercial pyrethrum-kerosene

preparation at least once a week for a fortnight before distributing the cards. The spray should be forced into all crevices and is best applied at night, when the silverfish are most active.

Investigations on the control of the oriental peach moth [*Cydia molesta*, Busck] in the Goulburn Valley (Victoria) [*cf.* **23** 725] have been continued. Two parasites, *Macrocentrus ancylivorus*, Rohw., and *Glypta rufiscutellaris*, Cress., introduced from the United States, have been liberated.

Insect Pests and Their Control.—*Agric. Gaz. N.S.W.* **47** pt. 11 pp. 629–633, 5 figs. Sydney, 1st November 1936.

The insect pests in New South Wales dealt with in this part of a series [*cf. R.A.E.*, A **25** 118] include the native Galerucid, *Monolepta australis*, Jac., which occurs in the north coastal districts and causes injury to the blossoms and foliage of *Citrus* and other fruit trees and maize. It also feeds on wattle [*Acacia*] and *Schinus molle*. It may be controlled by dusting or spraying with lead arsenate, or dusting with pyrethrum. Flares, made by wrapping a sack round the end of a pole and dipping it in kerosene, attract and destroy the beetles if carried between the fruit trees where they have settled for the night.

Risbec (J.). **Les parasites du caféier en Nouvelle-Calédonie.**—*Agron. colon.* no. 226 pp. 105–123, 1 ref. Paris, October 1936.

Observations are recorded on the insects and fungi that attack coffee in New Caledonia. The larvae of an unidentified moth made their galleries in the bark, and, when very numerous, ringed the trees or their branches, causing their death. Shrinking of the trunk, usually above the lowest branches, with resultant wrinkling of the bark, in which, on scraping, small holes may be seen, indicated attack by the larvae of a Curculionid, which is described, from one adult successfully reared by the author, as *Coffearhynchus neocaledonicus*, gen. et sp. n. The larvae first attacked the bark and then made tunnels in the heart of the branches ; well developed ones were found only in those with withered leaves. So far infestation has been limited to the stems of young plants or branches of about the thickness of a finger in plantations in mountainous districts where the shade trees are those of the primitive forest. The young plants are soon killed, and the older ones lose their branches and eventually die. Some planters consider that certain cases of damage to the fruits are caused by the adults of *Enicodes fichteli*, Schreib., and *E. montrouzieri*, Montr., but this was not confirmed. Larvae of these Lamiids were not found infesting coffee trees in plantations in which the adults occurred. Injury by *Araecerus fasciculatus*, DeG., to stored coffee was not very serious. Dr. Salomon has observed that this Anthribid cannot survive a temperature of 37°C. [98·6°F.] and suggests that exposure of infested coffee to the sun may be a suitable means of control. Small branches were so weakened by the oviposition scars of Cicadids, particularly *Ueana lifuana*, Montr., that they broke in any wind, especially when they were heavy with berries. Aphids, which were fostered by ants, were observed on the stems of the berries and sometimes caused the latter to shrivel and fall, but the damage was not widespread.

Albizzia (*Acacia*) *lebbek*, which is grown as a shade tree, is sometimes heavily infested, and even killed, by a species of *Embia*. It is also attacked by a termite, and in dry weather is often defoliated by Lepidopterous larvae.

ONOE (T.) & SATO (S.). **Fumigation Experiments with Chestnuts. 1. Effectiveness of Carbon Bisulphide against** *Balaninus dentipes* **Roelf.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 6 pp. 283–289. Tokyo, December 1936.

Curculio (*Balaninus*) *dentipes*, Roel., is very injurious to chestnuts in Japan. In experiments in which mature larvae that had emerged from harvested nuts were fumigated with carbon bisulphide [*cf. R.A.E.*, A **22** 239] at temperatures of about 17–20°C. [62·6–68°F.], the minimum rates of application required to give 100 per cent. mortality in 3, 6, 12, 18, 24 and 30 hours were equivalent to 13·6, 7·4, 4, 3, 2·4 and 1·8 oz., respectively, per 100 cu. ft.

KOJIMA (T.). **Influence of Temperature and Humidity upon the Growth of the Egg of** *Dendrolimus spectabilis* **Butl.** [*In Japanese.*] —*Oyo-Dobuts. Zasshi* **8** no. 6 pp. 299–307. Tokyo, December 1936.

Experiments showed that the duration of the egg stage of *Dendrolimus spectabilis*, Btlr., is shortened with a rise in temperature above 15°C. [59°F.] until it reaches a minimum at 32°C. [89·6°F.] when the relative humidity is 90–95 or 100 per cent., and at 30°C. [86°F.] when the humidity is 70–80 per cent. It is longer than the minimum at 33·2°C. [91·76°F.]. At temperatures above 19°C. [66·2°F.], it is prolonged by low humidity.

OUCHI (M.). **Influence of Temperature and Humidity upon the Oviposition of** *Bruchus chinensis* **L.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 6 pp. 308–314, 4 figs. Tokyo, December 1936.

Counts were made of the numbers of eggs laid daily by *Bruchus chinensis*, L., at different constant temperatures between 14·9 and 37·9°C. [58·82–100·22°F.] and different relative humidities between 17 and 100 per cent. The largest numbers were laid at 29·7°C. [85·46°F.], and at 93 per cent. humidity. The decrease in numbers at higher humidities was especially marked at high temperatures. The oviposition period was shortest at 35·9°C. [96·62°F.], and at 93 per cent. humidity. The optimum temperature and humidity are 30°C. [86°F.] and 90 per cent. At 25·3–35·9°C. [77·54–96·62°F.] and 93–90 per cent. humidity, the daily number of eggs increased up to the 4th day after emergence and then decreased.

FUKAYA (S.). **Parasites of** *Lymantria dispar* **L.** [*In Japanese.*]— *Oyo-Dobuts. Zasshi* **8** no. 6 pp. 332–335. Tokyo, December 1936.

Parasites reared from *Porthetria* (*Lymantria*) *dispar*, L., in Japan included *Pimpla* (*Exeristesoides*) *spectabilis*, Mats., and *Anastatus albitarsis*, Ashm.

KINOSHITA (S.). **Insect Injuries.** [*In Japanese.*]—*Bosai-Kagaku* **4** pp. 107–254, 1 pl., text-ill. Tokyo, October 1936.

In addition to giving accounts of the more important insect pests of agricultural plants in Japan and of measures for the control of pests, the author discusses the spread of noxious insects from one country to another and the introduction and utilisation of beneficial insects. In this discussion, many of the examples cited refer to Japan, so that the paper as a whole serves as a summary of the present position of agricultural entomology there.

ODA (F.). **Illustrated Book of Horticultural Insect Pests.** [*In Japanese.*] —333 pp., 5 col. pls., 299 figs. Tokyo, Meibundo, 1936. Price *Y*.4·80.

The origin and distribution of various pests that have spread over extensive areas are discussed, in connection with a review of plant quarantine regulations in force in Japan, and details are given of the bionomics and control of the more injurious insects in that country, with excellent illustrations.

ISHII (T.). **Practice of the Control of Insect Pests.** [*In Japanese.*]— 316 pp., 1 col. pl., 92 figs. Tokyo, Yokendo Publ. Co., 1936. Price *Y*.1·20.

This is a general survey of methods of controlling insects and also of various aspects of their bionomics, physiology and ecology, with brief individual notes on some of the more important pests in Japan. The results of many recent observations are included.

OZAKI (S.). **Detailed Accounts of Insect Pests of Agricultural Crops.** [*In Japanese.*]—534 + 64 pp., 253 figs. Tokyo, Index Kenbunkan, 1936. Price *Y*.6·20.

In addition to an account of the bionomics and importance of the chief insect pests of crops in Japan, this work includes a general discussion of insecticides and measures for insect control.

ESAKI (T.). **Rice Leaf-hoppers, 1–2.** [*In Japanese.*]—*Agric. & Hort.* **11** nos. 9–10 pp. 2179–2186, 7 figs., 2415–2422, 1 pl. Tokyo, October–November 1936.

Descriptions are given of the Jassids, *Nephotettix bipunctatus cincticeps*, Uhler, and *Deltocephalus dorsalis*, Motsch., and the Delphacids, *Delphacodes striatellus*, Fall., *Sogata furcifera*, Horv., and *Nilaparvata oryzae*, Mats., which are the most injurious Homoptera on rice in Japan, with notes on their bionomics. The 3 Delphacids are less active than the Jassids, but are gregarious and thus cause serious damage in small restricted areas.

YUASA (H.). *Chlorops oryzae* **Mats.** [*In Japanese.*]—*Bot. & Zool.* **5** no. 1 pp. 157–159, 4 figs. Tokyo, January 1937.

Chlorops oryzae, Mats., is widely distributed in Japan and attacks rice in the seed-beds and fields. It has three generations a year in the Okayama Prefecture and two in the Akita Prefecture, and hibernates

in the larval stage in wild grasses. The adults emerge from the grasses in late June and early July and oviposit on rice. The larvae attack the ears, and sometimes reduce the crop by 10–20 per cent.

KUWAYAMA (S.) & ONOZAKI (K.). **Studies on *Lema oryzae* Kuwayama, the Rice Leaf-beetle. V. Researches on the Implements collecting the Rice Leaf-beetle.** [*In Japanese.*]—*Rep. Hokkaido agric. Exp. Sta.* no. 37 pp. 1–42, 6 pls., 8 figs. Sapporo, Japan, March 1936. [Recd. 1937.]

This paper deals with various types of nets and scoops, some of which are mounted on wheels, that are dragged or pushed through fields of young rice to dislodge and collect *Lema oryzae*, Kuway., from the plants.

KUWAYAMA (S.). **Studies on *Lema oryzae* Kuwayama, the Rice Leaf-beetle. Part VI. Experiments with contact Poisons against the Rice Leaf-beetle.** [*In Japanese.*]—*Rep. Hokkaido agric. Exp. Sta.* no. 37 pp. 43–123. Sapporo, Japan, March 1936. [Recd. 1937.]

A detailed historical account is given of the use of insecticides for the control of *Lema oryzae*, Kuway., on rice in Japan, and experiments made during 1930–34 in Hokkaido are described. A spray of 6⅔ oz. pyrethrum and 5 oz. soap in 10 gals. water proved very effective against the eggs, larvae and adults, and one of nicotine sulphate and soap was more effective than derris.

KUWAYAMA (S.). **Insect Pests of Apple in Hokkaido.** [*In Japanese.*]—*Abstr. Lect. hort. Lect.-meet.* no. 4 pp. 87–118. Sapporo, Japan, March 1936. [Recd. 1937.]

An account is given of the history of the occurrence of injurious insects on apple and of the control measures used in Hokkaido. Over 200 insects are now known to attack apple in Japan, and 135 of these occur in Hokkaido. The more injurious include *Lepidosaphes ulmi*, L., which is said to have been imported from Germany on apple seedlings about 70 years ago, *Phenacoccus pergandei*, Ckll., *Rosanococcus suwakoensis*, Kuw. & Toyoda, *Eriosoma lanigerum*, Hsm., *Empoasca* (*Chlorita*) *flavescens*, F., *Tortrix* (*Archips*) *longicellana*, Wals., *T. dumetana*, Treitschke, *Argyresthia conjugella*, Zell., *Lithocolletis blancardella*, F., *Hyponomeuta padellus malinellus*, Zell., *Aporia crataegi adherbal*, Fruhst., *Acronicta incretata*, Hmps., *Alsophila punctigera*, Prout, *Agelastica coerulea*, Baly, *Rhynchites heros*, Roel., and *Scolytus* (*Eccoptogaster*) *aratus*, Bldf.

KUWAYAMA (S.). **A general Account of *Psylla pyrisuga* Foerst.** [*In Japanese.*]—*Kabutsu Geppo* no. 286 reprint 3 pp. Okayama, Japan, 1936.

Psylla pyrisuga, Först., is one of the most important pests of pears in Japan, where it is widely distributed. In Hokkaido, it has one generation a year, hibernating in the adult stage. The eggs are laid in the buds in early spring; one female may lay over 1,000 in the course of 2–4 weeks. The nymphs hatch in about a week and reach the adult stage 3–4 weeks later, after 5 moults. They may be controlled by spraying with nicotine sulphate and soap.

Ho (K. M.). **Studies on the Rose-borer,** *Neosyrista similis,* **Mocsáry (Hym., Cephidae).** [*In Japanese.*]—*Bull. Sci. Fak. Kjušu Univ.* **7** no. 2 pp. 185–210, 1 pl., 7 figs. Fukuoka, Japan, December 1936. (With a Summary in English.)

Neosyrista similis, Mocs., is widely distributed in Japan and causes serious injury to rose. It has also been found in Nanking, China. Near Fukuoka, where it has one generation a year, the adults begin to emerge in mid-April. Oviposition occurs in late April and early May, one egg being laid in each young shoot. Before oviposition, the female girdles the shoot with incisions made with its ovipositor. The larva hatches in about 10 days, and bores in the shoot for about a month. After this it spins a cocoon, in which it remains dormant until it pupates in the following spring. The pupal stage lasts 20–25 days. About 80 per cent. of the larvae are sometimes parasitised by Chalcidoids.

Ono (K.). **On the Rhododendron Pest,** *Boloschesis spilota* **Baly.** [*In Japanese.*]—*Insect World* **41** no. 1 pp. 11–12. Gifu, Japan, January 1937.

Brief notes are given on the Cryptocephalid, *Boloschesis spilota,* Baly, which feeds on the leaves of *Rhododendron* in Japan. Near Gifu, it has one generation a year.

Matsuda (M.). **Studies on** *Chrysomphalus aonidum,* **L. (XII).** [*In Japanese.*]—*J. Taihoku Soc. Agric. For.* **1** no. 3 pp. 251–257, 1 pl. Taihoku, Formosa, November 1936.

Observations are recorded on the situations in which both sexes of *Chrysomphalus ficus,* Ashm. (*aonidum,* auct.) were found on the leaves of *Quercus glauca* in Japan.

Koidzumi (K.). **Experimental Studies on the Influence of low Temperatures upon the Development of Fruit-flies. Seventh Report. On the fatal Action of low Temperatures upon the Eggs and Larvae of** *Chaetodacus ferrugineus* **var.** *dorsalis* **Hendel.** [*In Japanese.*]—*J. Soc. trop. Agric.* **8** no. 3 pp. 221–236. Taihoku, Formosa, October 1936.

In further experiments on *Dacus* (*Chaetodacus*) *dorsalis,* Hend., in Formosa [*cf. R.A.E.,* A **23** 370], eggs and larvae of various instars in *Citrus* fruits were exposed to constant temperatures between —8°C. [17·6°F.] and 10°C. [50°F.] for various periods at different seasons of the year. It was found that they were less resistant to low temperature in summer than at any other season. The eggs were more resistant than the larvae at the temperatures below —1°C. [30·2°F.] and less resistant at those above 1°C. [33·8°F.]. No pupae were obtained in the cultures when the eggs had been kept at —8°C. for 5 hours in summer, 10 in spring and autumn or 9 in winter, at —1°C. for 48 hours in summer or 72 during the other seasons, or at 10°C. for 1 month in summer or 40–50 days during the other seasons. The larvae did not pupate when they had been kept in the first instar at —8°C. for 4 hours in summer, 10 hours in spring and autumn or 9 hours in winter, at —1°C. for 48 hours in summer, 72 hours in spring and autumn or 96 hours in winter, or at 10°C. for 1 month in summer,

80 days in spring and autumn or 40 days in winter. The mature larvae did not pupate when kept at —8°C. for 4 hours in summer or 10 hours during the other seasons, or at 10°C. for 1 month in summer, 50 days in spring and autumn, or 80 days in winter.

TAKAHASHI (R.). **Some Observations on the Insect Pests of agricultural Plants in the mountainous Regions in Formosa.** [*In Japanese.*]—*J. Soc. trop. Agric.* **8** no. 3 pp. 237–240. Taihoku, Formosa, October 1936.

In the mountains of Formosa, the cultivated fields are small and isolated, so that the crops are liable to be attacked by insects coming from wild plants. In addition to polyphagous Acridids and Jassids, these pests include weevils that feed on chestnut, and the termite, *Procapritermes mushae*, Oshima & Maki, which is injurious to rice. In spite of the difference in temperature, insects from the lowlands are sometimes introduced. When this happens, they are often more injurious to a crop in fields in which it has recently been established than in those in which it has been cultivated for several years. Thus, restriction of serious injury to fields that had been under the crop concerned for only one year was observed in the case of outbreaks of the Pyralid, *Mampava bipunctella*, Rag., on Italian millet [*Setaria italica*] in 1932 and of the Pentatomid, *Eurydema pulchrum*, Westw., on radish in 1936. *E. pulchrum* and *Phyllotreta vittata*, F., have been found at altitudes of over 10,000 ft., and *Euxoa segetum*, Schiff., and *Plutella maculipennis*, Curt., at over 9,000 ft., all these insects being pests in the lowlands and in many other parts of the world.

MISAKA (K.), SUETA (H.), KOREISHI (T.) & UCHIDA (H.). **On the Relation of the Growth of Water Melon to the Injury of *Dacus cucurbitae* Coq. in Formosa. Materials for Plant Inspection, no. 1.** [*In Japanese.*]—*Publ. Bur. Ind.* no. 754, 38 pp., 2 pls. Taihoku, Formosa, October 1936.

Experiments and field observations in Formosa showed that *Dacus cucurbitae*, Coq., does not oviposit in uninjured fruits of water-melons after they have attained a circumference of a little over 9 ins., as by this time their skins are too hard. At present, water-melons for import into Japan from Formosa not only have to be inspected but also have to be 2 ft. in circumference ; it is proposed, however, to permit their importation if they are 1 ft. in circumference.

Results of Cotton Cultivation Experiments in Formosa. [*In Japanese.*] —*Bull. Res. Inst. Formosa* no. 122, 113 pp. Taihoku, Formosa, September 1936.

Of the 73 insects known to occur on cotton in Formosa, the more injurious include *Empoasca* (*Chlorita*) *biguttula*, Mats., *Dysdercus cingulatus*, F. (*megalopygus*, Breddin), *Aphis gossypii*, Glov., *Earias chromataria*, Wlk., *E. fabia*, Stoll, *Sylepta derogata*, F., and *Platyedra* (*Gelechia*) *gossypiella*, Saund. *E. biguttula* is the most serious pest. In the south part of the Island, where it has 13 generations a year, the eggs hatch in 6–28 days and the nymphal stage is completed in 7–8 days in summer and 24–25 in winter. The females lay their eggs singly in the stalks, leaf-veins or petioles, 5–10 days after emergence and 2–5 days after pairing. On plants about 8 ins. high, the eggs are generally

laid in the ribs of the leaves, but on those that have reached a height of 20 ins. they are generally found in the petioles and never in the stalks. The male adults live for about 3 weeks and the females for a few days longer. Infestation causes the leaves to curl and eventually drop, and reduces the crop. Varieties of cotton with leaves hairy on the under side are less injured than others. Effective control can be obtained by sprays of $2\frac{1}{4}$ lb. pyrethrum and $2\frac{1}{4}$ lb. soap in 100 gals. water, applied four times during the growing season; sprays of derris and soap have also given satisfactory results.

D. cingulatus causes considerable damage to cotton and also feeds on *Hibiscus*, sugar-cane, mango and other plants. It has 6 generations a year, the egg stage lasting 5–21 days and the nymphal stage 25–84. The eggs are laid in masses of about 90 in the soil, usually just below the surface, one female laying up to 4 masses. The adults are generally found on cotton after it has flowered; they attack the bolls, which are shed or fail to open. A species of *Lygaeus* is predacious on this cotton-stainer.

A new Method of Extermination of the Larvae of *Hispa armigera* Oliv. and its Result. [*In Japanese.*]—*Formosan agric. Rev.* no. 360 pp. 832–843. Taihoku, Formosa, November 1936.

The larvae and adults of *Hispa armigera*, Ol., cause serious damage to rice in Formosa and also feed on sugar-cane and *Zizania latifolia*. The egg and larval stages last 5–7 and 15–17 days, respectively, and there are 3 or 4 generations a year. It has been found that the larvae often emerge from the leaf-mines between 4 and 6 a.m. and crawl to other parts of the leaf or to fresh leaves. At this time, large numbers can be collected with nets; one man collected over 4,300 in 30 minutes. The adults, which generally emerge in the early morning, are found on the lower parts of the plant during the daytime and on the ends of the leaves in the evening, when they can be collected or killed by a spray of nicotine sulphate. Ducklings about a month old destroy large numbers of the beetles and are of value in their control, but older ducks cannot be used as they injure the rice plants.

Murayama (J.). **On the Larva and Food-plant of *Callipogon relictus* Semenov.** [*In Japanese.*]—*Kontyû* **10** no. 6 pp. 280–290, 1 fig. Tokyo, November 1936.

A description is given of the larva of the Prionid, *Callipogon relictus*, Semenov, which was found attacking *Carpinus laxiflora* in Korea.

Takahashi (R.). **Food Habits and new Habitats of the Formosan Psyllidae, with Notes on the peculiar Food Habits of some Formosan phytophagous Insects.** [*In Japanese.*]—*Kontyû* **10** no. 6 pp. 291–296, 1 fig. Tokyo, November 1936.

In Formosa, the food-plants of various Psyllids and other insects are different from those usual for the same species elsewhere. Thus, *Paurocephala psylloptera*, Crwf., attacks mulberry and sometimes *Trema orientalis* (Urticaceae), though it feeds on *Ficus* in India, Ceylon and the Philippines. *Mesohomotoma camphorae*, Kuway., occurs on *Hibiscus tiliaceus* and not on camphor [*Cinnamomum camphora*].

Thrips tabaci, Lind., is confined to onions, though it is polyphagous in other countries. *Stephanitis typicus*, Dist., attacks languas [*Alpinia galanga*], whereas it feeds on banana and other plants in China, Java and India. *Aleurolobus barodensis*, Mask., infests *Miscanthus* and not sugar-cane. *Eutettix disciguttus*, Wlk., is only found on *Rhododendron*, and the Aphid, *Aiceona actinodaphnis*, Tak., on *Actinodaphne*, though in Japan the former is polyphagous and the latter occurs on camphor.

NAKAYAMA (M.). **Studies on the Tortricid,** *Cacoecia xylosteana* **L.** [*In Japanese.*]—*Ann. agric. Exp. Sta. Chosen* **8** no. 4 pp. 205–212, 2 figs. Suigen, Korea, 1936.

Brief descriptions are given of all stages of *Tortrix* (*Cacoecia*) *xylosteana*, L., which is widely distributed on apple and pear in Korea. Near Suigen, it has only one generation a year. The adults occur in June and live for up to 10 days. Each female lays 32–206 eggs in 1–6 masses on the bark of the trees within 6–7 ft. of the ground, and in the forked parts of stems and branches. The larvae hatch in the following April, feed for about a month on the leaves and flower-buds and the surface of the young fruits, and then spin the leaves and flowers together and pupate among them. The pupal stage lasts about 11 days. The eggs should be collected or destroyed by spraying with oil emulsion or lime-sulphur before the buds open. Sprays containing nicotine sulphate or derris are effective against the young larvae, and lead arsenate against the older ones.

EGUCHI (M.). **Population Density, Habits and Rate of Growth of** *Gelechia gossypiella* **Saund. during the Cotton-cultivating Period.** [*In Japanese.*]—*Ann. agric. Exp. Sta. Chosen* **8** no. 4 pp. 213–227. Suigen, Korea, 1936.

In Korea, infestation of cotton by *Platyedra* (*Gelechia*) *gossypiella*, Saund., is more severe in fields near places where the crop is stored or dried than in outlying fields [*R.A.E.*, A **24** 787–788]. In the former, the numbers of eggs decreased from July to August and then increased, reaching a maximum in early September and October, when 1,700 were found per acre in 1934 and 2,000 in 1935. In the latter, they increased from July to a maximum in September, when 600 and 1,170 were found per acre. The eggs were deposited on the basal parts of the bolls and the buds, as well as on the lower surface of the leaves and, when the insects were abundant, on the stalks. The number of larvae increased gradually in July and August and rapidly in September. They were most abundant in late September and October just before harvest, when over 6,000 sometimes occurred per acre. The pupae, which were not investigated thoroughly, usually occurred in the soil, but were sometimes found in the bolls on the plants and rarely in the fallen bolls and petals.

Study and Control of Insect Pests.—*Misc. Publ. agric. Res. Bur. China* no. 5 (Rep. 1935) pp. 27–33. Nanking, 1936.

A survey of the borers overwintering in rice stubble was carried out in the early spring of 1935 in Kiangsu, Kiangsi, Anhwei, Hupeh,

Honan and Hunan. *Chilo simplex*, Btlr., was rather widely distributed, whereas *Schoenobius bipunctifer*, Wlk., was abundant only in the southern part of China and along the sea-coast. Experiments were made on the effects of temperature on the pupal stage and adult emergence of these two Pyralids and the Noctuid, *Sesamia inferens*, Wlk. The most favourable temperature for emergence of all three species was 27°C. [80·6°F.], at a relative humidity of 100 per cent. The number of days required for the pupal stage varied from 4 at 36°C. [96·8°F.] to 14 at 21°C. [69·8°F.] for *Schoenobius bipunctifer*, from 9 at 37°C. [98·6°F.] to 24 at 16°C. [60·8°F.] for *Sesamia inferens*, and from 6 at 33°C. [91·4°F.] to 9 at 24°C. [75·2°F.] for *C. simplex*. On the Bureau Farm [near Nanking], larvae of *S. inferens* were found feeding on *Cyperus japonicus*, *Miscanthus sinensis*, *Panicum crusgalli*, and *Rumex crispus*, which are common weeds.

Promising results in the control of rice-borers were obtained by introducing tobacco stems into the water of rice-fields. The nicotine in the stems dissolves in the water and kills newly hatched larvae on the surface, and it appears also that some of it is absorbed into the rice plants and renders them resistant to infestation. It is thought that the treatment would be best applied when the moths of the third generation are beginning to emerge, this being usually the hottest part of the year. From 132 to 264 lb. of tobacco stems are required per acre, and 1–2 inches of water must be kept on the field for 2 weeks after they are introduced. Methods of destroying the larvae that overwinter in the rice-stubble were also tested. In an untreated field the winter mortality was 67·5 per cent. Digging up the roots and leaving them unburnt resulted in a lower mortality rate. Keeping the field flooded for more than 50 days after harvest, and cutting off the roots about half an inch below the ground and leaving them for the winter were both effective, the latter treatment giving 99·1 per cent. mortality. In a field ploughed for a winter crop, the percentage mortality was 89·8 where the roots were exposed, and 63·1 where they were still covered with soil. In the latter case, however, most of the moths would die in spring, as they would be unable to escape.

Sprays of lead arsenate and of calcium arsenate, both at the rate of 2·4 lb. per 100 gals. water, gave 97·6 and 98 per cent. mortality, respectively, of larvae of *Cosmophila* (*Anomis*) *flava*, F., on cotton. Lead arsenate at the rate of 7·4 lb. per 100 gals. killed 52 per cent. of the cotton leaf-roller, *Sylepta derogata*, F., but calcium arsenate at the rate of 6·4 lb. killed only 4 per cent. The powdered leaves or root skin of *Celastrus angulatus* proved effective as an insecticide against *Phaedon brassicae*, Baly, on cabbage, and farmers have found that the powdered root skin of *Trypterigium wilfordi* is of value in its control.

In 1935, there was a serious outbreak of *Dendrolimus spectabilis*, Btlr., on pines in Nanking, but 20,000 trees were protected from injury by banding with an adhesive.

CHEO (Ming-tsang). **A preliminary List of the Insects and Arachnids injurious to economic Plants in China.**—*Peking nat. Hist. Bull.* **11** pt. 2 pp. 119–127. Peiping, December 1936.

This list, which is a continuation of previous ones [*R.A.E.*, A **24** 606, etc.], comprises 70 Lepidoptera, and shows the plants they attack and their distribution in China.

DA COSTA LIMA (A.). **Um novo Eumolpideo inimigo do algodoeiro (Coleoptera : Chrysomeloidea).** [A new Eumolpid Pest of Cotton.] —*Campo* **7** no. 83 pp. 35–36, 3 figs. Rio de Janeiro, November 1936.

A description is given of *Melinophora inglesiasi*, sp. n., adults of which have recently been found attacking the leaves of cotton in various parts of Brazil. The same Eumolpid was recorded as *Colaspis* sp. in a report published by F. Inglesias in 1915, which is reprinted. He stated that the adults cause serious injury to cotton and also attack mango, guava and other plants.

DA COSTA LIMA (A.). **Dois curculionideos daninhos no Rio Grande do Sul.** [Two harmful Curculionids in Rio Grande do Sul.]—*Campo* **7** no. 84 pp. 23–24, 7 figs., 3 refs. Rio de Janeiro, December 1936.

Two new weevils are described from Rio Grande do Sul (Brazil), *viz.*, *Pantomorus parsevali*, sp. n., attacking orange foliage, and *Lissorhoptrus oryzae*, sp. n., the larvae of which feed on the roots of rice. *L. oryzae* is closely allied to *L. simplex*, Say, which is also a pest of rice in Rio Grande do Sul.

STEINER (L. F.), SAZAMA (R. F.), FAHEY (J. E.), & RUSK (H. W.). **The Relative Efficiency of certain Lead Arsenate Spray Treatments.**—*Trans. Ind. hort. soc.* 1935 pp. 38–42. [Lafayette, Ind.] July 1936.

Further experiments [*cf. R.A.E.*, A **23** 600] were carried out in Indiana during 1935 on the use of lead arsenate in sprays for the control of the codling moth [*Cydia pomonella*, L.] on apple, and particularly of the first-brood larvae. One plot received Bordeaux mixture with lead arsenate at the rate of 4 lb. in 100 U.S. gals. for the first two cover sprays, on 22nd May and 3rd June, and at the rate of 3 lb. for the remaining 5 cover sprays, on 17th and 28th June, 17th and 30th July, and 13th August. Early in the season, the spray deposits and their effectiveness in controlling larvae decreased very rapidly between spray applications, and the average effectiveness increased as the relative rate of growth of the fruit slowed down and the spray deposit was built up. Between the applications of the seven-day spray (9th May) and the first cover spray on this plot, the surface area of the apples increased by 312 per cent., and the arsenic residue in another plot decreased from 127·8 to 52·8 mg. per individual apple ; thus a loss of about 59 per cent. of the deposit was due to weathering and the remaining deposit was therefore spread over 4 times the area. Between the first cover spray and the end of June the increase in area was 366 per cent., while during the next 80 days it was only 171 per cent.

Experiments in which samples of sprayed apples were exposed to infestation in the laboratory showed that, contrary to the common belief, the control of the first-brood larvae never exceeded 50 per cent. in tests during the 5 years up to 1935 and was always poorer than that of later broods. Among the treatments tested to obtain better control of first-brood larvae was the application of two special sprays, one 5 days before the first regular cover spray and one midway between the first and second cover sprays [*cf.* **25** 22]. To the first four applications (two special and two regular cover sprays), $\frac{1}{4}$ lb. soap (sodium

oleate) and 0·5 per cent. oil were added per 100 U.S. gals. With this treatment the mortality of the larvae was increased, greatly among the first brood, but only slightly among the second. There was no unusual injury to the trees, but heavy residues remained at harvest that were difficult to remove [*cf.* **25** 172].

SMITH (Edwin), RYALL (A. L.), MURRAY (C. W.) & CASSIDY (J.). **The Use of Low Viscosity Mineral Oils in Spray Residue Control.**—*Proc. Wash. St. hort. Ass.* **31** (1935) pp. 157–159. [Olympia, Wash.] 1936.

In further experiments [*cf. R.A.E.*, A **22** 218], carried out in 1935, on the removal of lead arsenate residues from apples, 1 per cent. mineral oil (viscosity 45 seconds Saybolt with 90 per cent. unsulphonatable residue) was added to the washing solutions of hydrochloric acid (1·5 per cent. by weight) or sodium silicate (60 lb. to 100 U.S. gals. water). The apples were exposed to the wash for 28 seconds in each section of the dual process washer, or for 41 seconds in the single process flood washer. The sprays that the apples had received included lead arsenate in combination with soap, fish-oil, or various types of mineral oil emulsion. The mineral oil was most effective in acid, either preceding or following a sodium silicate wash, and it was no more effective when used in both acid and alkali washes. A heated wash of oil and water followed by acid was as good as an alkali and oil wash followed by acid, but it was less effective when followed by alkali. The greatest increase in efficiency caused by the addition of mineral oil was obtained in cases where mineral oil had been used in the sprays applied to the fruit. Several comparisons of oils of 45 and 30 seconds viscosity, respectively, with hydrochloric acid in a single process flood washer, indicate that the oil of 30 seconds viscosity is slightly more effective. Emulsification of the oil with blood albumen is not necessary or desirable. Oil-washed fruit has a tendency to lose excessive moisture when exposed to high temperatures and low relative humidities, and should therefore be placed in cold storage as soon as possible. Very thorough rinsing, if possible with heat, is necessary when mineral oil is used in the wash. Oil washes should not be used for pears, as the presence of oil on pears may interfere with normal ripening.

BOUSQUET (E. W.), SALZBERG (P. L.) & DIETZ (H. F.). **New Contact Insecticides from Fatty Alcohols.**—*Industr. Engng Chem.* **27** no. 11 pp. 1342–1344, 7 graphs, 3 refs. Easton, Pa, November 1935. [Recd. March 1937].

In chemical investigations on the production of a contact insecticide more effective than the plant extractives now in use, long-chain alkyl derivatives were synthesised and tested. The rhodanates [thiocyanates] of the higher fatty alcohols proved to be the most satisfactory as regards efficiency, safety to foliage and practicability. Tests were carried out on the toxicity of the rhodanates containing even numbers of carbon atoms from 6 to 18, as well as on methyl, ethyl and butyl rhodanates. A few tests on the nonyl and undecyl compounds showed that rhodanates with an odd number of carbon atoms followed the trend of toxicity of those with an even number. Work on representative branched chain rhodanates was discontinued,

as they gave less promising results. Only the normal primary compounds are discussed in this paper. In experiments on their toxicity, potassium oleate was used with the rhodanates as a spreader, and the concentrations of both were chosen sufficiently low to bring out clearly the differences between the effectiveness of the homologues. The results are therefore indicative rather of the relative than the absolute toxicities. Each rhodanate was tested by several methods on the black and green chrysanthemum Aphids [*Macrosiphum sanborni*, Gill., and *Rhopalosiphum rufomaculatum*, Wilson], the green peach aphis [*Myzus persicae*, Sulz.], the red spider [*Tetranychus telarius*, L.] and thrips. The percentages of dead and moribund caused by different concentrations of each insecticide are plotted against the number of carbon atoms in the rhodanate in a series of graphs, from which its relative efficiency may be determined. The maximum efficiency against the green peach aphis, green chrysanthemum aphis and red spider is shown by the substance containing 12 carbon atoms (lauryl rhodanate) ; against the black chrysanthemum aphis by that containing 10 carbon atoms (decyl rhodanate) and against thrips by those containing 10 and 12 carbon atoms. Against red spider, lauryl rhodanate is outstandingly superior to the other homologues. The concentration-control curves from the tests on the green chrysanthemum aphis are also given for the various rhodanates, and from these the concentration of each homologue required to give 50 per cent. dead and moribund was determined. These figures are then plotted against the molecular weights of the insecticides ; the peak of efficiency is shown by the rhodanate containing 12 carbon atoms, which gives 50 per cent. dead and moribund at a dilution of about 1 : 3,000. This peak in physiological action does not appear to be correlated with any one physical property. The properties that are generally correlated with toxicity either increase or decrease progressively with molecular weight, having neither a maximum nor minimum. The surface tensions of the rhodanates increase, and the solubilities in water and the vapour pressure curves would certainly decrease, with increased molecular weight. Apparently, these properties reach a favourable balance in lauryl rhodanate.

Tests in the laboratory, greenhouse and field with both pure and commercial lauryl rhodanates showed that, at effective concentrations and in the proper dispersing medium, such combinations could safely be used on plants.

CUPPLES (H. L.). **Wetting and Spreading Properties of Aqueous Solutions. Mixtures of Oleic Acid with Potassium Hydroxide, Potassium Carbonate, and Ammonia.**—*Industr. Engng Chem.* **28** no. 4 pp. 434–436, 2 refs. Easton, Pa, April 1936.

The procedure in these experiments on the wetting and spreading properties of mixtures of oleic acid with potassium hydroxide, potassium carbonate, and ammonia was the same as that employed in the previous investigations in the series [*R.A.E.*, A **24** 213, 777].

The following is largely taken from the author's discussion of the results, which are presented in tables and graphs : Data are given for mixtures of ammonia and oleic acid containing 1·00 gm. oleic acid per 100 cc. Since these mixtures lose ammonia on exposure to the air, thus making the accuracy of the results somewhat uncertain, other concentrations were not studied. Mixtures containing 0·8 and 1·0

mole of ammonia per mole of oleic acid did not spread over a film of oil on celluloid. This may have been due to loss of ammonia from the soap mixture upon exposure to the air in a thin film. The other mixtures, containing more ammonia, did spread over the oil. Mixtures of potassium hydroxide and oleic acid were found to be similar to the corresponding mixtures of sodium hydroxide and oleic acid [**24** 213] in that the wetting properties are dependent upon the ratio of alkali to fatty acid, and a slight excess of alkali may greatly change these properties. Also, the mixtures of potassium carbonate and oleic acid were found to resemble closely the corresponding mixtures of sodium carbonate and oleic acid ; the carbonate mixtures are much less sensitive to variation of the ratio of alkali to fatty acid [**24** 778]. The mixtures of ammonia and oleic acid are also relatively insensitive to an excess of the base. These results indicate that the remarkable sensitiveness of the hydroxide mixtures to an excess of the alkali is due primarily to the action of the hydroxyl ion rather than of the sodium or potassium ion. This furnishes a possible explanation for the beneficial action of certain adjutants used in washing compounds, such as the silicates and phosphates. The stabilising effect of these compounds on the hydroxyl ion concentration may be responsible, at least in part, for their effectiveness.

MUNDINGER (F. G.). **Pear Midge in Relation to Fruit Set and Timing of Control Sprays.**—*J. econ. Ent.* **29** no. 6 pp. 1058–1063, 2 figs. Menasha, Wis., December 1936.

From 1931 to 1933 inclusive, studies were made in New York State of the growth of pears infested and uninfested by *Contarinia pyrivora*, Riley [*cf. R.A.E.*, A **19** 352]. A graph of the changes in size of the fruits from 13th May to 8th June shows that infested pears develop very rapidly at first, but that, after about a fortnight, growth is arrested and the fruits decrease in size and fall, whereas the rate of growth of uninfested fruit is uniform. In clusters having only uninfested, both infested and uninfested, and only infested fruits, an average of 1·1 pears or 60·5 per cent. of the original number set, 0·43 pears or 15 per cent., and no pears, respectively, had developed by the middle of June. The average normal drop from clusters containing 1, 2, 3 and 4 uninfested fruits was 25, 50, 42 and 75 per cent., respectively. The total loss from clusters of 1–4 fruits of which 1 or 2 were infested varied from 73 per cent. when 1 was infested and 3 uninfested to 100 per cent. when the only fruit was infested. The total loss due to *C. pyrivora* varied from 11 per cent. in the case of clusters of 4 fruits, which are rare, to 75 per cent. when only 1 fruit had set. The percentage loss of uninfested fruits from clusters having both infested and uninfested pears is nearly always greater, sometimes by as much as 48, than that from clusters having uninfested pears only. It is thought that the additional fall of uninfested fruit may be due to greater food assimilation by infested pears during the period of abnormally rapid growth. During 1933, it was observed that the adults oviposit on the 4 most distal blossom buds on the peduncle. No uninfested pear set and remained on a terminal pedicle after 20th June, and, of clusters having only uninfested fruit, only 38 per cent. bore any on the 4 most distal pedicles. Thus, satisfactory control depends on the careful timing of sprays to destroy adults of *C. pyrivora*, which emerge just before the flower buds swell, before they are able to oviposit in the 4 most advanced

buds. One spray is usually adequate unless emergence is prolonged or the development of buds is arrested by cold, in which case two may be beneficial.

SMITH (G. L.) & YOUNG (M. T.). **Field Movement of Boll Weevils in Relation to initial Infestation and Rainfall.**—*J. econ. Ent.* **29** no. 6 pp. 1063–1066, 1 fig. Menasha, Wis., December 1936.

The numbers of boll weevils [*Anthonomus grandis*, Boh.] taken on adhesive screens in 9 cotton fields in north-eastern Louisiana during 1933, 1934 and 1935 were positively correlated with the total rainfall during June, July and August and with the number of days with 0·3 in. or more rainfall during those months. In each year, there was a high and fairly uniform infestation by overwintered weevils during May and early June, infestation being higher in 1934 than in 1933 or 1935, and the catch of weevils on screens for June 1933, 1934 and 1935 was 64, 102 and 27, respectively. For June, July and August of 1933, 1934 and 1935, the total rainfall was 18·46, 11·23 and 6·89 ins., and 0·3 in. rain or more fell on 14, 9 and 5 days, respectively. The catch of weevils on screens from June to November was 5,232 in 1933, 2,573 in 1934 and 396 in 1935. This decrease is shown graphically to be almost directly proportionate to the decrease in the number of days on which rainfall was 0·3 in. or over, and to bear nearly as direct a relation to the total rainfall during the 3 months. Of the total rainfall and days with 0·3 in. or more during June, July and August, more than 50 per cent. occurred in July in 1933 and in June in 1934 and 1935. The number of weevils caught in September 1933 was higher than that caught in August of the same year, but in 1934 and 1935, the catches for September were much lower than those for August. Heavy catches in November 1933, October and November 1934, and October 1935, were due to the flights of the weevils seeking hibernation quarters, which occurred at different times on account of varying climatic conditions and other factors.

FOLSOM (J. W.). **Additional Notes on little-known Cotton Insects.**—*J. econ. Ent.* **29** no. 6 pp. 1066–1068. Menasha, Wis., December 1936.

Brief notes are given on 19 species of Coleoptera taken on cotton in Louisiana in 1935. Most of them have not hitherto been recorded on cotton, but all cause some injury, though none is abundant. They are controlled by the calcium arsenate treatment [*cf R.A.E.*, A **24** 255, etc.] applied against the boll weevil [*Anthonomus grandis*, Boh.].

DUNNAM (E. W.). **Pilosity of the Cotton Plant in Relation to Adherence of dusted Calcium Arsenate.**—*J. econ. Ent.* **29** no. 6 pp. 1085–1087, 1 fig. Menasha, Wis., December 1936.

During 1934, the hairiness of 75 varieties of cotton was studied in Mississippi and was found to be fairly stable under different conditions. Two varieties were selected, one very hairy, with an average for various parts of the plant of 4·89 hairs per sq. mm., and the other very smooth, with only 0·55 hairs per sq. mm., and two plots were sown in 1935 with the two varieties in alternate rows. On 28th July, when the plants were thoroughly wet with dew, one plot received two applications

(each at the rate of 10 lb. per acre) of calcium arsenate dust, which is commonly used for the control of the boll weevil [*Anthonomus grandis*, Boh.] and the cotton leaf worm [*Alabama argillacea*, Hb.]. After an interval of 2 hrs., 500 disks, $2\frac{1}{2}$ ins. in diameter, were cut from the leaves of each variety. These samples were washed in 5 per cent. solutions of nitric acid and the solutions were analysed. Further samples were tested in the same manner 3 days later. On 9th August, when the plants were thoroughly dry, the whole experiment was repeated on the other plot. The more hairy variety retained more arsenic pentoxide under all like conditions. When dusted wet, the smooth variety retained 321 mg. per 100 disks (about 291 sq. ins.) after 2 hrs. and 205 after 3 days, whereas the hairy variety retained 377 and 233, respectively. When dusted dry, the latter retained 102 mg. after 2 hrs. and 58 after 3 days, and the former 63 mg. after 2 hrs. and 38 after 3 days. The percentage of adherence for the smooth variety after 2 hrs. and 3 days, calculated on the basis of the hairy variety, was significantly greater when plants were dusted wet.

Snapp (O. I.) & Thomson, jr. (J. R.). **Experiments with new Materials to control Peach Borer.**—*J. econ. Ent.* **29** no. 6 pp. 1088–1092, 1 ref. Menasha, Wis., December 1936.

Experiments carried out in central Georgia from 1932 to 1935 on the control of *Aegeria* (*Conopia*) *exitiosa*, Say, in peach trees confirmed previous conclusions as to the value of an emulsion of crude cottonseed oil impregnated with paradichlorobenzene [*R.A.E.*, A **20** 632]. In the autumn of 1935, $\frac{1}{4}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{1}{2}$, $\frac{1}{2}$, and 1 U.S. pt. of the emulsion per tree, carrying $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{1}{2}$, and $\frac{3}{4}$ oz. paradichlorobenzene, on nursery stock before it was dug, and trees one, two and three, four, five, and six years old gave 100, 66·7, 100, 58·7, 80·8, and 100 per cent. control, respectively, with little or no injury to the trees. The orchard of 4-year-old trees was much more heavily infested than the others. These results were inferior to those obtained during previous years, probably on account of the drought and high temperature, which caused rapid diffusion of the gas before it reached the bottom of the main root. Paradichlorobenzene crystals, applied at the rate of $\frac{3}{4}$, $\frac{3}{4}$ and 1 oz. per tree to trees four, five and six years old, gave 92·3, 100 and 100 per cent. control, respectively, with severe injury in the case of trees four and six years old. On younger trees, injury was excessive. Of the new materials tested, ethylene dichloride emulsion [**22** 640], made by stirring 9 parts (by volume) of ethylene dichloride into 1 part of potash fish-oil soap (30 per cent. soap and 70 per cent. water) and diluting to the required strength, gave the best control of *A. exitiosa* and was the safest material used for nursery stock before it was dug and orchard trees of all ages under the conditions of the autumn of 1935. On nursery stock and trees one, two, three, four, five and six years old, 4, 10, 5, 10, 15, 15 and 20 per cent. emulsions, the first two used at the rate of $\frac{1}{4}$ U.S. pt. per tree and the others at $\frac{1}{2}$ U.S. pt. per tree, gave 100, 85·7, 100, 100, 85, 92 and 100 per cent. control with little or no injury to the trees. Previous experiments with nursery stock after digging up indicated that 4 per cent. ethylene dichloride emulsion sprayed on dry, well packed soil around trees heeled in an upright position, at the rate of 1 U.S. qt. to a bundle of 15 trees, will give practically 100 per cent. control without injuring the trees if the application is made while they are still dormant. An emulsion of amylene dichlorides was very

injurious to nursery stock at concentrations that gave only fair control of *A. exitiosa*. One of mixed amyl chlorides at the same concentration was neither effective against the borer nor injurious to the trees. At present prices in the United States, the cost of treating trees with ethylene dichloride is only a little over half that of treating them with crude cottonseed oil and paradichlorobenzene. It is thought that the control recorded is lower than that actually obtained, as the presence of more borers on untreated than treated trees indicated that small larvae had been killed and had decomposed. Many eggs were also probably destroyed. Under local conditions, 20th to 25th October was shown to be a better time for treatment than 10th to 15th October, as is now recommended.

RAINWATER (C. F.). **Further Studies on Cotton-root Aphid and other subterranean Aphids in South Atlantic States.**—*J. econ. Ent.* **29** no. 6 pp. 1092–1095, 1 fig. Menasha, Wis., December 1936.

A survey, made during the spring of 1935, of the subterranean Aphids damaging cotton in the southern Atlantic States [*R.A.E.*, A **24** 25] showed that *Anuraphis maidiradicis*, Forbes, is present from southern Georgia to south-eastern Virginia, though injury in southern Georgia is slight, *Rhopalosiphum* sp. is found fairly frequently in south-eastern Virginia and eastern North Carolina and occasionally in South Carolina, and *Trifidaphis phaseoli*, Pass., is abundant in North Carolina and Virginia and in some places in South Carolina. None of the three species was found in northern Florida. These Aphids do much more damage than is generally supposed. Their presence is usually indicated by the occurrence of ant hills round the base of the plants. During the winter of 1934–35, it was ascertained that each species maintains a subterranean habitat continuously, without producing sexual forms. Asexual females, which were usually wingless, and nymphs, were found on different food-plants throughout the winter. During cold weather, the nymphs are inactive and the period between the moults is increased ; the females are also inactive, the rate of reproduction is decreased and longevity increased. When warm weather occurs during winter, normal activity is resumed. At 40·1–45°F. the average lengths of the period of development and adult life of *Rhopalosiphum* sp. were 25·3 and 14·5 days, and the average number of young produced, 16 ; at 85·1–90°F. the corresponding figures were 4·7, 7·1 and 38·5. This species was reared through 70 consecutive generations on sprouted cotton seed in small vials in which humidity was constantly high. A thermograph continuously recorded the temperature, which on one occasion fell to 15°F. For a period of 10 days, the minimum was below freezing and the mean 34·15°F. The sprouts were often frozen solid. Mortality was higher during this cold period than at other times, especially among first and second instar nymphs, but enough always remained to maintain the stock and an increased number of alate individuals was produced. These could always be produced by crowding several nymphs in one vial. When the Aphids were reared singly at spring or summer temperature, the occurrence of alate individuals was rare.

These three Aphids and also *Anoecia querci*, Fitch, *A. corni*, F., *Anuraphis* sp., *Aphis* sp. and *Forda* sp. were found on the roots of a number of plants other than cotton in eastern South Carolina ; a table shows the plants from which each species was collected.

GAINES (R. C.). **Boll Weevil Activity during normal Hibernation Period at Tallulah, La.**—*J. econ. Ent.* **29** no. 6 pp. 1096–1099, 1 fig., 2 refs. Menasha, Wis., December 1936.

This paper deals with observations made in Louisiana from 21st December to the end of February during six winters, on the relation between temperature and the activity of adults of the boll weevil [*Anthonomus grandis*, Boh.] hibernating in cages. Records were made almost daily, and the maximum temperature on the day of record was taken to be the temperature affecting activity. One weevil was found active on a day when the maximum temperature was only 36°F., but all others were found when the temperature was 40° or higher. Of the total number of weevils recorded as active, the percentages observed when maximum temperatures were 36–45°, 46–55°, 56–65°, 66–75° and 76–81°F. were 1, 7·6, 20·1, 36·9 and 34·4, respectively, and the average numbers of weevils found to be active each day at those temperatures were 5·5, 9·5, 18·7, 23 and 62·7. The number of weevils found to be active during the period of hibernation was 2·65 per cent. of the total number in the cages, but it is probable that some weevils were counted more than once. On the other hand, some of the weevils died before the end of February, thus reducing the total number that might become active.

Examination of adhesive screens, situated in infested cotton fields, during the hibernation periods of the years 1931–35, indicated that there was no flight at maximum temperatures of less than 62°F. Of the total of 385 weevils taken on these screens, 2·3, 32 and 65·7 per cent. were taken with maximum temperatures of 62–65°, 66–75° and 76–83°F., respectively.

SCHOPP (R.). **Observations on Life History of Lily Bulb Thrips** *Liothrips vaneeckei* **Priesner.**—*J. econ. Ent.* **29** no. 6 pp. 1099–1103, 2 figs., 1 ref. Menasha, Wis., December 1936.

Data on the biology of *Liothrips vaneeckei*, Priesn., obtained in a laboratory in Washington State differ considerably from others obtained in the field ; records made in England [*R.A.E.*, A **24** 108] differ still more from the latter. In the laboratory, at mean temperatures of 65·4, 65·7, 66·7, 68·3, 67, 68·5 and 67·8°F., respectively, the egg, first-instar larval, second-instar larval, prepupal, prepupal and pupal, and adult stages, and the period from emergence till the laying of the first egg averaged 17·2, 16, 19·9, 2·8, 13·1, 70·3 and 25·5 days. The average total period from egg to adult at 70–75°F. was 48·2 days. The thrips were reared individually on lily scales in glass vials.

Weekly observations of the proportions of the different stages in lily bulbs in the field throughout 1934 and 1935 showed that the overwintering individuals were chiefly second-instar larvae and adults in about equal numbers, but that about 3–4 per cent. were first-instar larvae. In 1934, each group appeared to pass through 1½ generations, an alternation in the overwintering stage being indicated. The time required for development from egg to adult appeared to be about 100 days. It is possible that one of the groups might be eliminated by shorter developmental seasons so that there would be only one group going through a single generation in a season. In 1934, eggs were first

noted on 26th February and pupae on 26th March, and in 1935 they were noted on 17th April and 7th May, respectively. These differences are probably due to temperature.

DOUCETTE (C. F.). **Observations on Bulb Scale Mite as a major Pest of Narcissus.**—*J. econ. Ent.* **29** no. 6 pp. 1103–1105. Menasha, Wis., December 1936.

An examination of samples from 21 stocks of narcissus bulbs stored in the Pacific north-west in 1935 showed that at least 14 were infested with *Tarsonemus approximatus* var. *narcissi*, Ewing. A description is given of the habits of the mite and the injury it causes [*R.A.E.*, A **22** 489] ; it is now realised to be a major pest, especially of forced bulbs. Its presence in the field is difficult to detect. Distribution over long distances is probably only effected by transport of infested bulbs. Spread from bulb to bulb is slow in the field, but at the higher temperature of a cool greenhouse, the mites spread from a central infested bulb to all others in a forcing tray in three weeks. In an experiment, infested and uninfested bulbs were stored together in the proportion of 1 : 5 and samples were examined after 3 months. Some of the bulbs with one flowering shoot were not infested ; those that were contained an average of 632 mites. Bulbs with two flowering shoots were all infested and contained an average of 6,058 mites per bulb. The unexamined bulbs, which were forced, were all seriously damaged and produced only 15 per cent. of the normal number of flowers, not one being of marketable quality.

Complete mortality of all stages of the mite can be obtained by submerging the bulbs in water at 110°F. for 1 hour or by exposing them to vapour-heat at 110–111°F. for 2 hours.

GETZENDANER (C. W.). **Parasitizing European Earwig with *Bigonicheta setipennis* Fall. Recent Developments in Methods and Equipment.**—*J. econ. Ent.* **29** no. 6 pp. 1105–1114, 7 figs. Menasha, Wis., December 1936.

During experiments carried out in Washington on the propagation and establishment of *Bigonicheta* (*Digonochaeta*) *setipennis*, Fall. [*R.A.E.*, A **20** 23], a Tachinid parasite of the European earwig, *Forficula auricularia*, L., from a stock sent from Europe in 1931, several devices to reduce the time spent in routine operations were developed. Descriptions are given of a trap for the collection of third-instar earwigs to serve as host material, mating and oviposition cages for the parasites, apparatus for stimulating oviposition by them by attracting them to anaesthetised hosts, the anaesthetising outfit, galvanised iron boxes for keeping the parasitised earwigs, and a rotary sifter for recovering the parasite puparia. The procedure adopted throughout is detailed, including the method of parasitising the earwigs. A parasite trap for field recovery, which is attached to the earwig trap and obviates much collecting and rearing, is also described. Using this technique and equipment during 1935, one person, with part-time assistance, reared 8,000 Tachinids, parasitised 80,000 earwigs, and liberated 1,800 gravid female parasities and 500 puparia in 17 colonies in Washington and Idaho. From 200 earwig and parasite traps distributed and later examined, 52 Tachinids were recovered, and 21,000 earwigs were collected, from which 73 Tachinids were reared.

Bailey (S. F.). **California Christmas Berry Thrips *Rhynchothrips ilex* (Moulton).**—*J. econ. Ent.* **29** no. 6 pp. 1114–1117, 1 fig., 5 refs. Menasha, Wis., December 1936.

Rhynchothrips ilex, Moult., was described in the genus *Trichothrips* and referred by J. D. Hood to *Liothrips*, but the author and Moulton both now consider it to belong to *Rhynchothrips*. It occurs in California and its distribution, except where heat or rainfall are excessive, probably coincides with that of the Christmas berry (*Photinia arbutifolia*), the only plant on which it reproduces. An account is given of its life-history, including information obtained by F. J. Spruyt in 1924–25. The adults hibernate singly or in groups in the leaves that have curled as a result of infestation during the season, or under old scales, etc. on the food-plant. Hibernating adults of *Leptothrips mali*, Fitch, and *Hercothrips fasciatus*, Perg., have been found with them. When plant growth starts in the spring, they come out of hibernation, pair and feed on the young leaves. Oviposition begins 10–15 days later and continues for about a month; the adults often live for 2½ months in spring. The eggs are deposited on the foliage and usually hatch in 3–4 weeks. The newly hatched larvae feed with the adults upon the young leaves, causing them to become distorted or even to die. The larval stage lasts 18–28 days. There is one moult on the food-plant when the larva is about half-grown and another when it is entering the prepupal stage. When mature, the larvae drop to the ground and often spend as much as 18 days seeking a suitable place for pupation in the dry top soil or the bark at the base of the food-plant, or under stones or leaves. Pupation occurs when the plant is in flower, usually in June or July, and during this time very little injury is done, as the adults of the preceding generation are dead. In the laboratory, the prepupal stage lasted 2 days and the pupal 8–15; in the field, the pupal stage lasts about 2 weeks. After emergence, the adults remain in the place of pupation for 1–3 weeks, after which they crawl on to the new growth or berries, but they feed and oviposit very little, many going straight into hibernation. The second-brood larvae mature about the beginning of October, but it is doubtful whether the pupae survive the winter rains.

The adults, although they have fully developed wings, have never been observed to fly, and spread is slow. Artificial dissemination takes place on nursery stock moved when the adults are hibernating in the leaves. Suggested control measures are picking off and destroying all curled leaves in autumn, winter or early spring; spraying the adults and larvae, as soon as they appear in the spring, with a contact insecticide; and hosing the plants and the ground beneath thoroughly with water during the summer.

Edwards (W. D.) & Mote (D. C.). **Omnivorous Leaf Tier, *Cnephasia longana* Haw. A relatively new Pest of Strawberries, Iris and other Crops in Oregon.**—*J. econ. Ent.* **29** no. 6 pp. 1118–1123. Menasha, Wis., December 1936.

Most of the information contained in this paper on *Cnephasia longana*, Haw., in Oregon has already been noticed [*R.A.E.*, A **23** 134]. A list of its food-plants is given; they comprise 29 common plants of 12 families. When adults were confined in small cages over strawberry plants, eggs were usually deposited singly on plant débris

or on leaves and clods of earth, but, in glass tubes, many are found in clusters. In 1932, 1933 and 1934, the incubation period averaged 14·6, 15 and 16·9 days, respectively. Data obtained during 1933 and 1934 indicated that there is a period of activity after hatching, during which the larvae seek a place in which to hibernate and make a hibernaculum of silken web, but that feeding does not begin until the spring. Wheat has been added to the list of economic food-plants ; the larvae feed on the kernels, which are usually attacked in the soft dough stage, and damaged about 5 per cent. of the heads in one field. The parasites that have been recorded from *C. longana* are the Ichneumonids, *Phytodietus burgessi*, Cress., *Glypta* sp. and *Angitia* (*Dioctes*) *eureka*, Ashm., and the Braconids, *Microbracon hyslopi*, Vier., and *M. gelechiae*, Ashm., of which the last-named is the most important.

NEWCOMER (E. J.). **Effect of Cold Storage on Eggs and young Larvae of Codling Moth.**—*J. econ. Ent.* **29** no. 6 pp. 1123–1125, 1 fig., 1 ref. Menasha, Wis., December 1936.

As oil-emulsion treatment to kill eggs of the codling moth [*Cydia pomonella*, L.] on harvested apples and pears [*R.A.E.*, A **18** 541] was found to interfere with the ripening of the fruit, further experiments were made on the effect of cold storage on eggs and very young larvae working under the skin. At 30–31°F., the temperature range used in commercial practice, a continuous exposure of 23 days killed 96·5 per cent. of the eggs, and an exposure of 28 days gave over 99 per cent. mortality of eggs and 100 per cent. of young larvae. Incidental observations on the effect on older larvae in the centres of the fruits showed that exposures of 14, 21 and 28 days killed 10·4, 18·2 and 55·8 per cent., respectively.

LATTA (R.). **Experiments with Oil Sprays to control Rhododendron Whitefly.**—*J. econ. Ent.* **29** no. 6 pp. 1125–1128, 2 refs. Menasha, Wis., December 1936.

In view of the discovery of well established infestations of *Dialeurodes chittendeni*, Laing, on rhododendron in western Washington in 1933, experiments on its control with lubricating oil sprays were begun in 1934. There is one generation a year. Larvae are present from July to April, pupae in April and May, and adults in late May and June. Sprays were applied from 5th December 1934 to 10th October 1935 to test their efficiency during the peak periods of all larval stages and the pupal stage. An oil with a viscosity of 100–110 seconds Saybolt and an unsulphonated residue of 74–76 per cent., and a heavy oil with a viscosity of 90–100 seconds and an unsulphonated residue of 94 per cent. were applied during the autumn, winter and spring ; a summer grade oil with a viscosity of 70–75 seconds and an unsulphonated residue of not less than 90 per cent. was applied in July and August ; and a commercial oil emulsion was applied early in the spring. No differences in effectiveness were noted between oils emulsified with casein and ammonia by the method of E. J. Newcomer and R. H. Carter [*R.A.E.*, A **21** 608] and tank-mixed emulsions with a commercially prepared spreader. Sprays containing 1 per cent. actual oil gave 80·2–100 per cent. mortality ; those containing 2 per cent. oil gave over 90 per cent. mortality in every test and 100 per cent. in many instances ; sprays prepared from heavy oil at strengths of 3 and

4 per cent. gave 100 per cent. mortality in one test each ; sprays containing 4 per cent. summer oil gave 100 per cent. mortality ; and 3 per cent. summer oil gave 100 per cent. in one test and 99·4 in another. Where mortality was over 90 per cent., the population did not increase to injurious proportions until the second year after treatment. The sprays are effective against larvae at any stage, but, if applied before January, they prevent the formation of sooty mould, which develops in the spring when larval activity is increased, and discoloration of the leaves by the feeding of the larvae. If the sprays are applied in the early autumn, before cold causes the rhododendron leaves to droop, it is easier to obtain the complete coverage on which effectiveness depends. Control measures can be applied at once against new infestations, by using oil sprays for the larvae or pupae and nicotine sulphate in either a spray or a dust for the adults. Incidental observations showed that the oil sprays had no effect on *Stephanitis rhododendri*, Horv. (rhododendron lacebug), and a spray of nicotine sulphate applied for the control of this Tingid gave only partial control of the larvae of *D. chittendeni*. None of the oil sprays injured the plants.

Lindgren (D. L.). **Vacuum Fumigation.**—*J. econ. Ent.* **29** no. 6 pp. 1132–1137, 10 refs. Menasha, Wis., December 1936.

Work on vacuum fumigation is reviewed from the literature, and an account is given of studies in California on fumigation with hydrocyanic acid gas, at atmospheric pressure and in dissipated and sustained vacuums. The tests were carried out at 70–75°F. on adults of *Hippodamia convergens*, Guér., 30–40 of which were placed in small wire cages. All exposures were for 1 hour. There was no mortality among controls kept at atmospheric pressure, and 6 per cent. mortality among beetles kept in a vacuum for the same length of time. Commercial liquid HCN (96–98 per cent.) was used. In the experiments at atmospheric pressure, the HCN was measured into the fumigatorium, and the circulating fan was allowed to run for 1 minute at intervals of 5 minutes. In experiments on sustained vacuum, the insects were placed in the fumigatorium, and a vacuum of 27 ins. was obtained. The HCN was then admitted and enough air allowed to reduce the vacuum to 26·5 ins. At the end of an hour, the vacuum had usually fallen to about 23 ins. In the experiments on dissipated vacuum, the procedure was the same, but air was allowed to enter until the pressure was equal to that of the atmosphere. In an empty fumigatorium, 100 per cent. mortality was obtained with 4 cc. HCN per 100 cu. ft. in a sustained vacuum, and 5 cc. in a dissipated vacuum ; at atmospheric pressure, 6 cc. gave 97·9 per cent. mortality. When the cages containing the beetles were placed inside sacks of dry soil so that the gas had to penetrate 2 ins. of soil to reach them, 4 cc. HCN was sufficient to produce complete mortality in a sustained vacuum, which was 4–5 times as effective as a dissipated vacuum and 8–10 times as effective as no vacuum. When the soil was wet, the results with no vacuum and a dissipated vacuum were very irregular ; in a sustained vacuum, 10 cc. HCN was necessary to give complete kill. When the cages were placed in boxes loosely packed with wood shavings, adsorption was a factor as well as penetration and the difference between the three pressures was not great. In a sustained vacuum, 20 cc. was required to give complete control, and 30 cc. at atmospheric pressure. Complete kill was not obtained when the cages were placed in the centre of a

rolled bundle of 50 burlap sacks. In a sustained vacuum, 75 cc. HCN gave 98·6 per cent. mortality, while all the beetles survived fumigation at atmospheric pressure with 150 cc.

MARSHALL (James) & GROVES (K.). **Field Methods for Investigation of Codling Moth Insecticides.**—*J. econ. Ent.* **29** no. 6 pp. 1137–1144, 2 figs., 1 ref. Menasha, Wis., December 1936.

An example from a typical apple orchard in Washington State is given to show that, on trees that have received uniform treatment and on which there is a reasonably even spray deposit, there may be a great difference in the population of codling moth [*Cydia pomonella*, L.] at the end of the year, and it is inferred that correct data cannot be obtained by comparing results from materials under experiment with those on a small number of controls sprayed with a standard insecticide. In a method adopted by the authors, the distribution of the infestation was estimated by comparison with numerous control plots. Then, assuming that the intervening experimental plots had been controls, theoretical infestations were interpolated. The actual infestation for each experimental plot was compared with the interpolation. Next, each experimental plot was compared with the adjacent control plot on a percentage basis by multiplying by a hundred the difference between the number of larvae per 100 apples for the control plot and the number for the experimental plot divided by the number for the control plot, and the experimental error, estimated by comparing each control plot with an adjacent control plot, using the same formula, was subtracted from the result. In every case, the order of efficiency of given insecticides was the same by either method of comparison.

Only large differences should be considered, and in the case of new spray mixtures, these should be reproducible over at least three years. Spray deposits should be determined, and experimental error must be taken into account. If sampling is done carefully, only about 300 apples per tree need be examined. The procedure adopted at Wenatchee and the method of presenting the results are described.

DAHMS (R. G.), SNELLING (R. O.) & FENTON (F. A.). **Effect of several Varieties of Sorghum and other Host Plants on Biology of the Chinch Bug.**—*J. econ. Ent.* **29** no. 6 pp. 1147–1153, 2 figs. Menasha, Wis., December 1936.

In 1935, the effect of different varieties of *Sorghum* and other foodplants on *Blissus leucopterus*, Say, was studied in Oklahoma. In general, there was a correlation (positive in the first case and negative in the others) between the resistance of a variety, its tolerance to a uniform infestation, the number of eggs laid by, and longevity of, the females, the rapidity of development and condition of the nymphs, and the percentage of bugs on it when it was exposed to infestation with another variety in a cage.

SEARLS (E. M.) & HARRIS (H. H.). **Handy Insect Cages made from Cellophane.**—*J. econ. Ent.* **29** no. 6 pp. 1158–1160, 4 figs. Menasha, Wis., December 1936.

A description is given of a method of constructing cages from cellophane that is permeable to moisture, for containing, moving and observing small insects. The cage is shaped like an envelope and is slightly larger than the plant or part of a plant to be enclosed with the insects.

Adhesive tape is used to close the sides and to fix the envelope to the stem or petiole, expansion of which is allowed for by a band of absorbent cotton-wool that also prevents the loss of insects through their sticking to the adhesive. A hole in one side of the envelope, covered with fine-mesh fabric fixed with the same tape, provides ventilation.

HANSBERRY (T. R.) & RICHARDSON (C. H.). **Toxicity of certain Stomach Poisons to several common Lepidopterous Larvae.**—*J. econ. Ent.* **29** no. 6 pp. 1160–1166, 10 refs. Menasha, Wis., December 1936.

The authors discuss the materials and methods used in experiments to determine the median lethal dose (M.L.D.) of certain stomach poisons for various Lepidopterous larvae. The technique is a modification of the sandwich method devised by F. L. Campbell and R. S. Filmer [*R.A.E.*, A **18** 311]. Leaf disks of known area were dusted under a large bell jar. The amount of poison on each disk was estimated by weighing a rectangular paper, 10 times the area of a single disk, before and after exposing it to the dust with the disks. For insects of medium size and compounds of which the M.L.D. was 0·3 mg. per gm. or less, it was found to be satisfactory to expose a single disk, powdered side downwards on damp sand, to the feeding of the larva. In the case of relatively non-toxic compounds, the paste sandwich method was used. The amount eaten by the larvae was calculated by counting, under a binocular microscope, the number of square millimetres that were exposed when the partly eaten leaf disk was superimposed on a circle of the same size marked on millimetre cross-section paper.

The remainder of the paper is summarised as follows: The authors report 23 determinations for Lepidopterous larvae and compile 60 more from the literature. From these data, comparisons of toxicity of a poison for different insects and of different poisons for the same insect are made. For larvae of *Bombyx mori*, L., several organic toxicants including rotenone and some of its derivatives, nitro-phenols, and certain of the coal-tar dyes are most toxic. Following these are lead arsenate and many of the common fluorine insecticides. In the least toxic group are various arsenicals and organic and inorganic compounds. The M.L.D. of lead arsenate, for larvae of various species, ranged from about 0·05 mg. per gm. body weight for three species of *Datana* to 0·25 and 0·26 for *Heliothis armigera*, Hb. (*obsoleta*, F.) and *Cirphis unipuncta*, Haw. The observations and comparisons made indicate a rather specific action of many poisons for various Lepidopterous larvae.

BRONSON (T. E.). **Effect of Ground Derris upon Pea Aphid when infesting Peas subsequent to spraying.**—*J. econ. Ent.* **29** no. 6 pp. 1170–1172, 1 ref. Menasha, Wis., December 1936.

During 1935, experiments against *Macrosiphum onobrychis*, Boy. (*Illinoia pisi*, Kalt.) were continued in Wisconsin with the object of determining whether derris sprays protect pea foliage from becoming infested after they have been applied [*cf. R.A.E.*, A **24** 717]. Small, uninfested potted pea plants were given a thorough application of a spray consisting of 3 lb. ground derris (3·2 per cent. rotenone and 13 per cent. total extractives) per 100 U.S. gals. water with a spreader and wetting agent. They were then allowed to dry for 24 hours, lightly infested with nymphs of *M. onobrychis* in the third and fourth

instars and caged. Some control plants were sprayed with nicotine sulphate in water (1 : 800) with a spreader and wetting agent, and others were untreated. At the end of 7 days, the plants sprayed with derris, those sprayed with nicotine sulphate and the untreated ones had respectively 84, 1,417 and 1,734 Aphids for every 100 of the original infestation. Most of the original Aphids placed on the plants treated with derris died in 48–72 hrs. A slight amount of reproduction occurred, but the young nymphs did not develop normally.

Hutson (R.). **Bill-posters' Paste in Mite-control Sprays.**—*J. econ. Ent.* **29** no. 6 p. 1173. Menasha, Wis., December 1936.

During 1936 in Michigan, an infestation of *Tetranychus telarius*, L. (*bimaculatus*, Harv.) on apples, the leaves of which carried plenty of sulphur, was completely controlled by one thorough application of a spray made of dry bill-posters' paste at the rate of 4 lb. to 100 U.S. gals. water. This material, which does not foam, is economical, is compatible with most insecticides and fungicides, and does not discolour plants noticeably, was subsequently used with complete success against mites on raspberries, beans and dahlias. It proved of no value against flea-beetles and certain Rhynchota.

Herman (F. A.) & Hockey (J. F.). **Control of Potato Flea Beetle, *Epitrix cucumeris* Harr.**—*J. econ. Ent.* **29** no. 6 pp. 1173–1174. Menasha, Wis., December 1936.

In an experiment in Canada in August 1936, "Cubor 75" dust (0·75 per cent. rotenone) and derris-gypsum dust (0·4 per cent. rotenone) were applied in the evening to a small bed of tomato plants heavily infested with *Epitrix cucumeris*, Harr. One hour later, the ground was thickly dotted with wriggling beetles, all of which were dead by morning. On the next day, there were no flea-beetles on the plants and 0–12 dead ones per sq. inch on the ground, and after 10 and 19 days, there were only occasional beetles on the tomatos, although an adjacent plot of potatoes was infested.

Moore (J. B.). **Calcium Cyanide for Control of Squash Bug, *Anasa tristis* De G.**—*J. econ. Ent.* **29** no. 6 p. 1174. Menasha, Wis., December 1936.

Pyrethrum and nicotine dusts gave negative results against *Anasa tristis*, DeG. (squash bug) in New York in 1936, but calcium cyanide, applied with a bellows duster, had killed 1,295 of the 1,376 bugs examined, 24 hours after treatment. However, scorching was noticeable on all the plants treated. It was later observed that the bugs congregate on the ground beneath the plants about an hour before sunset, and an application of the dust to the ground at this time gave practically 100 per cent. mortality and did not injure the plants.

Lindgren (D. L.). **Methyl Bromide Fumigation of Codling Moth Larvae.**—*J. econ. Ent.* **29** no. 6 pp. 1174–1175. Menasha, Wis., December 1936.

In some walnut packing houses in California, all empty sacks are vacuum fumigated for 1–2 hours to kill larvae of the codling moth

[*Cydia pomonella*, L.] before being returned to the growers. The sacks are tied into bundles of 50, and as many as possible are fumigated at the same time with hydrocyanic acid gas or carbon bisulphide. As there was some doubt as to the effectiveness of these fumigants [*cf. R.A.E.*, A **21** 595], in view of the short exposure and the large amount of absorptive material, experiments with them were carried out in 1935. Dosages of 200 and 150 cc. HCN per 100 cu. ft. with a sustained vacuum of 26 ins. and exposures of 1 and 4 hours gave only 46 and 37 per cent. mortality, respectively, of naked larvae in the centre of a bundle of sacks. A dosage of 3 lb. carbon bisulphide and a large amount of carbon dioxide per 100 cu. ft. killed only 15 per cent. In view of these unsatisfactory results, tests were made with other fumigants, of which a commercial product containing 3·4 per cent. methyl bromide and 96·6 per cent. carbon dioxide, used at the rate of 5 lb. per 100 cu. ft., gave a complete kill of the larvae in the sacks.

BARBER (G. W.). **Method of rearing Corn Earworm Larvae.**—*J. econ. Ent.* **29** no. 6 pp. 1175–1176. Menasha, Wis., December 1936.

During 1935 and 1936, a method of rearing larvae of *Heliothis armigera*, Hb. (*obsoleta*, F.) without isolating them, as was previously thought to be necessary on account of their cannibal habits [*R.A.E.*, A **24** 304], was developed in Connecticut. A bottomless cage, 2 ft. high, of copper gauze on a wood frame, with boards 8 ins. wide forming the lower portion, was placed on a cement slab, and a layer of soil 8 ins. deep was put into it. A cover of roofing paper excluded rain. Eight 1 × 2 in. boards, with nails driven through them 2½ ins. apart, were fitted into grooves along the front and back of the cage an inch above the soil, and ears of maize, picked before the tenth day after silking, were infested with two newly hatched larvae each and fixed on the nails, which were so placed that the ears did not touch. Such maize remains fresh until the larvae have completed their development, and they seldom migrate from it until they drop off to pupate in the soil. They may be collected then, or recovery may be deferred until the pupal or adult stage. From a lot of 98 ears, 122 larvae, most of which were fully developed, were recovered after 20 days. The larvae developed to their normal size and in the usual period. Infestation is more likely to occur when two larvae are used per ear than when only one is used.

VANSELL (G. H.). **Lesser Wax Moth found in Oregon and California.**—*J. econ. Ent.* **29** no. 6 p. 1176. Menasha, Wis., December 1936.

Adults of *Achroia grisella*, F., were taken in southern California and in Oregon in September 1936. Larvae were active in occupied beehives, but the tunnels were hard to find.

MCDANIEL (E. I.). *Leptocoris trivittatus* **Say killed by a sulfonated higher-alcohol Spray.**—*J. econ. Ent.* **29** no. 6 p. 1176. Menasha, Wis., December 1936.

A teaspoonful of a sulphonated higher alcohol in powder form in 1 U.S. qt. water was found to make an effective contact spray for the control of nymphs and adults of *Leptocoris trivittatus*, Say, on box elder [*Acer negundo*] in Michigan.

Stehr (W. C.) & Farrell (W.). **Two Hemipterous Enemies of the Mexican Bean Beetle in Ohio.**—*Ohio J. Sci.* **36** no. 6 pp. 332–333, 2 refs. Colombus, Ohio, November 1936.

An adult of the Pentatomid, *Perilloides* (*Perillus*) *circumcinctus*, Stål, and a nymph of the Reduviid, *Arilus cristatus*, L., were each observed feeding on *Epilachna varivestis*, Muls. (*corrupta*, Muls.) on beans in Ohio. The Pentatomid was kept in a cage with a bean plant and adults of the beetle, of which it destroyed a total of 85 in 27 days. The Reduviid was similarly caged but was given both adults and larvae, of which it destroyed 69 and 22, respectively, in 28 days. At the end of this period it had become an adult, having moulted twice. Neither of these bugs is sufficiently plentiful to give any effective control of the beetle.

Shirck (F. H). **Plowing as a Means of destroying Wireworm Pupae in the Pacific Northwest.**—*Circ. U.S. Dep. Agric.* no. 407, 8 pp., 2 refs. Washington, D.C., November 1936.

The following is substantially the author's summary : Studies were made to determine the effect of ploughing on wireworm pupae in the irrigated lands of southern Idaho. *Pheletes* (*Limonius*) *californicus*, Mann., and *P.* (*L.*) *canus*, Lec., the principal species involved in the tests, pupate in the second half of July and the first half of August and pass about 3 weeks in the pupal stage. The larvae and adults are not easily killed, but the pupae are extremely fragile and easily killed by injury, high temperatures, or the drying of the soil. Ploughing to destroy the pupae should be carried on during the first week of August in southern Idaho. It has been found that on the average approximately 75 per cent. of the pupae of *Pheletes* can be killed. This represents a practical aid to wireworm control that can be accomplished with no additional expense except that involved in ploughing to an average depth not more than 3 inches greater than the ploughing depth now in vogue. Apparently the best results are produced by ploughing to a depth of 8 or 9 inches and leaving the soil surface rough.

No significant number of immature larvae are killed by ordinary ploughing methods. Mechanical injury is apparently responsible for the greater part of the pupal mortality, supplemented by the effect of exposure to summer heat and low humidities. Fields that have been in small grain and those devoted to the production of early vegetable crops, such as peas and early potatoes, can be ploughed during the optimum period for destroying wireworm pupae.

Shirck (F. H.) & Lanchester (H. P.). **Wireworm-infestation Trends accompanying certain Crop Rotations in the Pacific Northwest.**—*Circ. U.S. Dep. Agric.* no. 408, 9 pp. Washington, D.C., November 1936.

As previous observations in Idaho had indicated that infestation by wireworms varies in intensity under different conditions of farming, the long-term experiments here discussed were begun in 1931 to determine the effect of different crop rotations. Five acres of land of volcanic ash origin with a high percentage of silt and clay were used

for the experiments. The long life-cycle of wireworms, ranging from 2 to 5 years, together with the necessity for repeating the crop rotations, renders it impossible to make final and complete recommendations for control from the experiments so far conducted. *Pheletes* (*Limonius*) *californicus*, Mann., was found to be the predominant species, and *P.* (*L.*) *canus*, Lec., comprised about 10 per cent. of the infestation.

The following is substantially the authors' summary: Fluctuations in wireworm infestations have been observed for 4 seasons under a variety of crop rotations. Plots containing lucerne, with low initial populations, showed a gradual though significant increase in the number of wireworms during the 4-year period. Abnormal conditions for wireworm survival may be developed through the growing of red clover or through intensive drying out of the soil. The former results in rapid increases in the number of wireworms. The drying of the soil was partly obtained through the growing of unirrigated wheat, in which case decreases exceeding 50 per cent. of the wireworms resulted in one season. In the case of late vegetable crops, where a dry mulch was maintained during much of the season of beetle flight, the infestation remained about stationary. The only significant effect upon the infestations under pasture-sod conditions was the reduction of the population in a plot that had a high initial infestation. Plots planted with sugar-beet and general garden crops showed an increase in the number of wireworms fully as significant as that with lucerne, although not so consistent. The variation in the crops included in this rotation may account for the irregularities.

VAN DYKE (E. C.). **Another destructive Death Watch Beetle.**—*Pan-Pacif. Ent.* **12** no. 4 p. 178. San Francisco, Calif., December 1936.

An Anobiid found to be doing severe damage to an old Spanish bureau in western California was identified as *Eupactus* (*Thaptor*) *oblongus*, Gorh. This species is very destructive to woodwork in Mexico.

LANGE, jr. (W. H.). *Peritelopsis globiventris* (**Lec.**) **infesting Roots of the Globe Artichoke.**—*Pan-Pacif. Ent.* **12** no. 4 p. 195. San Francisco, Calif., December 1936.

Considerable injury to the roots of artichokes [*Cynara*] by adults of *Peritelopsis globiventris*, Lec., was observed in the central coastal region of California in June 1936. This weevil is uncommon in the sand dune areas, and the infestation, which undoubtedly spread from native plants in the vicinity, was very localised.

FLANDERS (S. E.). **Two Mealybugs of the Genus** *Puto* **attacking** *Citrus*.—*Pan-Pacif. Ent.* **12** no. 4 pp. 196–197. San Francisco, Calif., December 1936.

Puto yuccae, Coq., and another species of the genus, probably *P. spinosus*, Robinson, are recorded as infesting *Citrus* in California and in Australia and India, respectively. Characters distinguishing the two species are given.

JACOT (A. P.). **Why Study the Fauna of the Litter?**—*J. For.* **34** no. 6 pp. 581–583, 3 refs. Washington, D.C., June 1936. [Recd. February 1937.]

The feeding of minute animals that occur in forest litter decreases the size of the particles in the litter and so accelerates the reduction (by bacteria and moulds) of this supply of potential food to a form available to the trees. Excluding worms and the larger insects, there are 120–150 species and thousands of individuals of these minute animals to the square foot of litter. Some of them eat out dead roots, tunnel the litter and aerate the soil beneath, so that the rain is able to carry the food to the roots of the trees. In many localities, the forest litter is only reduced slowly, and in others, such as in woodland developed on abandoned fields, the products of reduction may not reach the roots of the trees as, owing to the absence of these animals, the litter and soil are not sufficiently porous. The author therefore suggests that the exact species that perform these various functions should be investigated, with a view to their introduction into regions where they do not occur.

HORNIBROOK (E. M.). **The Effectiveness of partial Bark Peeling in the Control of** *Ips*.—*J. For.* **34** no. 6 pp. 620–622, 2 refs. Washington, D.C., June 1936. [Recd. February 1937.]

Four species of *Ips*, *I. lecontei*, Swaine, *I. oregoni*, Eichh., *I. integer*, Eichh., and *I. ponderosae*, Swaine, are common on *Pinus ponderosa* in Arizona and New Mexico. They infest injured and fallen trees, but are seldom dangerous to vigorous living stands, except where logging operations are suddenly curtailed and there is insufficient slash for the increased population. In experiments carried out in Arizona during 1935, 4 lots of 5 logs (4 ft. long and 4–8 ins. in diameter) were partly peeled to leave strips of bark 2, 3, 4 and 5 ins. wide, respectively, and another lot was kept as a control with no bark removed. They were placed in small openings in the stand under normal conditions for such logs, so that the insects had free access. One end of each log was supported 6–8 ins. above the forest floor. At the time the experiment was started, a new generation of *I. integer* and *I. oregoni* was emerging on adjacent ground. The logs were infested within 24 hours, and, within a week, infestation was heavy on all logs except those with the strips of bark 2 ins. wide. The first maturing adult was observed after 59 days, and after 65 days the bark was shaved off and counts of the new living adults were made. The numbers of attacks, determined by counts of the nuptial chambers, were 15, 45, 46 and 54 in the strips 2, 3, 4 and 5 ins. wide, respectively, and 88 in the control logs. No adults were found in the logs with 2-inch strips, and 10 of the 15 attacks had been abandoned after galleries 2–4 ins. long had been constructed. The numbers of new adults maturing in the strips 3, 4 and 5 ins. wide represented 17·28, 44·24 and 57·01 per cent. of the number maturing in the control logs, which was 1,198. In the 3-inch strips, an average of 4·6 adults matured per attack, which is only slightly greater than the number per attack entering the log, which has been given by different workers as 1 male and several females or 1 male and 1–3 females. In the 3-inch strips, the greatest mortality of larvae and pupae occurred on the upper part and sides of the logs, apparently because the bark dried from the edges towards the centre. The wider strips did not dry so much, and the mortality in them was

lower. It is concluded that the partial peeling of poles, leaving the bark in 3-inch strips, is sufficient to prevent any great increase in a population of *Ips*.

PARK (T.) & WOOLLCOTT (N.). **Studies in Population Physiology. vii. The Relation of Environmental Conditioning to the Decline of** *Tribolium confusum* **Populations. (Abstract.)**—*Anat. Rec.* **67** suppl. no 1 p. 127. Philadelphia, Pa, 25th December 1936.

The following is a copy of the abstract : An analysis was made of the effect of 5 per cent., 10 per cent., 15 per cent., 20 per cent., 25 per cent., 50 per cent., 75 per cent. and 100 per cent. conditioned flour (flour taken from senescent *Tribolium* cultures) on the fecundity and fertility of the beetle, *Tribolium confusum*, Duv. It was shown that, in general, the rate of egg production varied in inverse ratio with the conditioned flour content of the medium. The fertility, on the other hand, was not appreciably altered by such differential conditioning. These physiological relations are discussed as factors contributing to the decline of *Tribolium* populations [*cf. R.A.E.*, A **24** 613, etc.].

HOFFMAN (C. H.). **A Population Study of** *Cacoecia cerasivorana* **Fitch with special Reference to its Insect Parasites (Tortricidae-Lepidoptera).**—*Bull. Brooklyn ent. Soc.* **31** no. 5 pp. 209–211, 3 refs. Lancaster, Pa, December 1936.

Data on the bionomics of *Tortrix* (*Cacoecia*) *cerasivorana*, Fitch, in the United States are briefly reviewed from the literature. Its normal food-plant is choke-cherry [*Prunus virginiana*], but the larvae also feed on other plants, including cultivated cherry, apple and raspberry. They hatch in spring from eggs laid in the previous summer on the bark of choke-cherry and spin large nests, which may enclose whole branches or even shrubs. They pupate in these nests, and there is one generation a year. In mid-June 1932, the author collected nests containing larvae and pupae from choke-cherry in eastern Minnesota. A few of the moths had already emerged, but the greatest number did so in the second week of July. On 11th July, he collected 43 additional nests and kept the enclosed branches standing in water at 23°C. [73·4°F.] for 2 weeks. Examination then showed that the colony, including adults and parasites that had emerged meanwhile, consisted of 4,102 moths, 271 living and 3,657 dead pupae, 68 living and 320 dead larvae, 285 Hymenopterous parasites, and 552 Dipterous parasites. Of the Dipterous parasites, about 94 per cent. were *Nemorilla maculosa*, Meig., and about 6 per cent. *Phorocera tortricis*, Coq. ; one adult of *Schizocerophaga leibyi*, Tns., was also reared. The Hymenopterous parasites included *Pimpla* (*Itoplectis*) *conquisitor*, Say, *Triclistus curvator*, F., *Microdus* (*Bassus*) *agilis*, Cress., *Cremastus epagoges*, Cushm. (one only), and *Dibrachys cavus*, Wlk. The last species, which was one of the most common, was not only a primary parasite of *T. cerasivorana*, but also a secondary parasite attacking *Phorocera tortricis*, *Nemorilla maculosa* and, probably, *Pimpla conquisitor*.

MAHEUX (G.). **Le puceron des carottes.** *Myzus persicae* **(Sulzer) dans la région de Québec en 1936.**—*Nat. Canad.* **63** no. 10 pp. 233–236. Quebec, October 1936.

Up to 1936, *Myzus persicae*, Sulz., was almost unknown in the Province of Quebec, but in that year it became numerous in market

gardens, where, however, it was only found on the leaves of carrots. No such infestation seems to have previously been recorded. The injury varied from 5 to 60 per cent. of the crop, with an average of 12 per cent.

SQUIRE (F. A.). **Report on the Entomological Division for the Year 1935.**—*Divl. Rep. Dep. Agric. Brit. Guiana 1935* pp. 105–108. Georgetown, 1936.

During 1935, the rainfall in British Guiana was slightly below the average, except during June, and very well distributed, and in consequence there were outbreaks of an unusual number of minor pests. The Dynastids, *Dyscinetus geminatus*, F., and *D. bidentatus*, Burm., were again not recorded on sugar-cane, their absence being attributed to the enduring effects of the floods of January 1934 [*R.A.E.*, A **24** 260]. During investigations on rice stalk borers from March 1935 to February 1936, it was noted that *Diatraea saccharalis*, F., was present in fractional percentages until January, when 2·8 per cent. of the stems examined were bored and parasitism by *Spilocryptus diatraeae*, Myers, rose to an average of 50 per cent. *Microdus stigmaterus*, Cress. (*diatraeae*, Turner), the only other parasite recorded, occurred in very small numbers. *Scirpophaga albinella*, Cram., was more abundant than *Diatraea* throughout the period of the investigation and also increased in numbers in January, when 14 per cent. of the stems examined were bored by it. The increase was followed by that of the Braconid parasite, *Hecabolus* sp., which was active throughout the period, and parasitised about 20 per cent. of the larvae in January. Localised outbreaks of *Colaspis hypochlora*, Lef. [**24** 461], the development of which is checked by periodical drought, occurred on bananas on the coast. Search for the subterranean forms was unsuccessful, but several egg clusters were obtained from adults in captivity.

SQUIRE (F. A.). **Notes on the Yellow Aphis of Sugar-cane *Sipha flava* Forbes.**—*Trop. Agriculture* **14** no. 1 pp. 3–4, 3 refs. Trinidad, January 1937.

A comparison is made of the life-history of an Aphid that attacks sugar-cane in British Guiana and is here called *Sipha flava*, Forbes [*cf. R.A.E.*, A **24** 260] and that of the same species in Illinois. In British Guiana, the sexual generation is absent [*cf.* **23** 145]. The life-cycle from egg to adult is completed in an average of 4 days, the period of reproduction lasts about 20 days, and the longevity is about 30 days. The averages of the corresponding figures for Illinois are 13·3, 27·6, and 49·6 days, according to J. J. Davis. A female produces about 60 offspring, at the average daily rate of about 3 in British Guiana and 2·5 in Illinois. In British Guiana, the Aphid is found wherever sugar-cane occurs, throughout the coastal belt of the Provinces of Demerara and Berbice. Severe infestation is sporadic and favoured by prolonged rains, high humidity and little sunshine. All stages of the cane are attacked, and damage depends largely on the age of the stand. The suggestion that the death of the leaves is due to the injection of toxins by the Aphid as well as to the removal of the sap is not supported by observations in British Guiana, as even large colonies are slow in killing the leaf, and small ones do not cause any symptoms. Infestation is confined to the underside of the leaf, possibly because of the shelter

afforded, as, when the leaves were tied so that the undersides were uppermost, the sheltered surface was still preferred. During the equinoctial dry seasons, the Aphid survives in small colonies, often fostered by *Solenopsis* [*cf.* **17** 24]. Selection may lead to its being more tolerant of dry conditions, and so becoming a more important pest in British Guiana. Predators [*cf.* **17** 25] do not thrive in conditions most suitable to the Aphid. For its control on young plants, a spray containing nicotine sulphate [**23** 145] has been used successfully.

PICKLES (A.). **The Control of Froghopper Blight.**—*Trop. Agriculture* **14** no. 1 pp. 5–9. Trinidad, January 1937.

Cultural methods for counteracting the effect of the sugar-cane froghopper [*Tomaspis saccharina*, Dist.] in Trinidad are discussed. Eggs occur mostly in the soil to a depth of 4 ins., although about 1 per cent. are found in the trash [*cf. R.A.E.*, A **20** 94]. For oviposition, heavy soils are preferred to sandy ones, and wet soils to dry ones, so that a major factor determining the distribution of infestation in any locality liable to attack is the moistness of each field relative to the surrounding ones. As many as 80 per cent. of the nymphs may be found below the surface of the soil to a depth of 6 ins. Lesions are produced on the leaves of the sugar-cane by the saliva injected by the adult in the process of feeding, and in severe infestations the whole surface of the leaf may be affected. The reduction of effective area in the leaves may cause the rate of production of roots to decrease or stop entirely, and then the plant suffers from lack of water. If soil conditions are poor, this may result in serious injury. The most severe attack is due to the second brood and so takes place in July and August, when soil drainage is poor, owing to the drains being choked, and when weeds interfere with the growth of the cane.

The provision of adequate drainage is urged, so that active development of the roots is encouraged before they are seriously affected. Deep ploughing and cultivation are also recommended to strengthen the roots. In two adjacent areas attacked by the froghopper, one that had been deeply ploughed recovered quickly and completely, and the roots when dug appeared strong and healthy, while the other never completely recovered, and the roots appeared dead and unhealthy. Resistant canes (such as Co. 213) and those with good recuperative powers (such as Uba) should be planted in districts liable to attack. It is suggested that ammonium sulphate should be applied to the cane, not later than the first appearance of the adults, to stimulate leaf growth. The only reliable method of preventing infestation is to plough up the fields in which oviposition has occurred, and this is not always justified by the general level of attack.

MARTIN (J. T.). **Occurrence of Rotenone in *Tephrosia macropoda* Harv.**—*Nature* **137** p. 1075, 6 refs. London, 27th June 1936. [Recd. 1937.]

Tests were carried out on the toxicity to *Aphis rumicis*, L., of *Tephrosia macropoda* [*cf. R.A.E.*, A **20** 444] from Natal, using a cold alcoholic extract of the finely ground root diluted with saponin solution. At concentrations equivalent to 0·25 and 0·1 per cent. of the root, the percentages of Aphids moribund and dead on the third day after spraying were 95 and 50, respectively. When an ether

extract, amounting to approximately 4 per cent. of the root, was taken up in warm carbon tetrachloride and allowed to stand overnight, crystals were deposited. These, after recrystallisation from absolute alcohol, melted at 162°C., and showed a methoxyl content of 15·75 per cent. There was no depression of the melting point on admixture with pure rotenone. The rotenone was present to the extent of 0·3–0·4 per cent. of the root. By steam distillation of the resin extracted from the root by means of alcohol, " tephrosal " was obtained. Other crystalline derivatives of the rotenone group were isolated, but the work is to be extended and the detailed examination of the roots will be reported later. It is suggested that the insecticidal properties of *T. macropoda*, which is widely distributed over the greater part of South Africa, merit further investigation, and that, possibly by selection and suitable cultural methods, a sufficiently rich variety might be obtained for use as an insecticide, particularly in the control of local insect pests.

HARGREAVES (E.). **Fruit-piercing Lepidoptera in Sierra Leone.**—*Bull. ent. Res.* **27** pt. 4 pp. 589–605, 6 figs., 15 refs. London, December 1936.

A list is given of the fruit-piercing Noctuids found at Njala, Sierra Leone, showing the months in which they have been observed attacking *Citrus* or other fruits [*cf. R.A.E.*, A **24** 336]. A second list enumerates the species recorded as fruit-piercers in other countries, and a third the food-plants of the larvae in different countries, including Sierra Leone. There, the most abundant species were *Hypocala rostrata*, F., in 1926, *Achaea catocaloides*, Gn., in 1930–1932, 1934 and 1935, and *Othreis fullonia*, Cl. (*fullonica*, L.) in 1928, 1933 and 1936. In 1936, *A. catocaloides* was practically absent. The relative numbers vary from year to year, but, next to *A. catocaloides*, *A. faber*, Holl., and *A. mormoides*, Wlk., are usually more numerous and active over a longer period than the others.

Othreis divitiosa, Wlk., *O. fullonia*, and *O. materna*, L., all attack *Citrus*, cashew [*Anacardium occidentale*] and mango, but show no marked preference for soft fruits. They are active at night, sheltering in the denser tree foliage during the day. The larvae occur on leaves of plants of the family Menispermaceae and pupate in slight silken cocoons in leaves that they have folded or brought together. Very humid conditions of climate or micro-climate are apparently favourable to development, but heavy rains or a low relative humidity are not. This is thought to account for the presence of these species on different food-plants throughout the year. Thus, larvae of *O. fullonia* were observed on the small-leafed twining plant, *Tiliacora*, only during changes of season when the rain is not heavy and the humidity is not low; at other times almost all were found on *Triclisia*, a large-leafed semi-twining plant with dense foliage near the ground. When, owing to heavy morning mists such as occur in November and December, the relative humidity was very high and much condensed moisture was present, the larvae left the food-plants trailing near the ground for species with a higher growth, and did not return till towards the middle of the morning, when much of the moisture had disappeared. If pupation occurred in dry surroundings, the adults were often unable to

emerge successfully. In areas in which *Tiliacora* and *Triclisia* were common, but where the vegetation had been reduced to the orchard bush type, larvae were rare or absent. A few examples of an Ichneumonid were obtained from larvae of *O. divitiosa* and *O. fullonia*, and 4 parasites from 1 egg of the former. Bats were the main predators. The larvae of these three moths are described ; the times required to complete the larval and pupal stages varied slightly with the species but were within the limits of 13–20 and 10–18 days, respectively.

Moths of the genus *Achaea* showed a preference for soft fruits, but only 6 of the 15 species taken were of economic importance. Adults of *A. catocaloides*, which is thought to be a migratory species, appeared in a battered condition at about the end of March and oviposited on leaves then or in early April. The egg, larval, pupal and pre-oviposition periods (of locally bred individuals) occupied 2–3, 18–20, 7–8, and 4–5 days, respectively. The larvae occur on a variety of food-plants, but the more important are *Ochthocosmus africanus* and *Phyllanthus discoideus*. The main local generation emerged in early May and there was a marked difference in the ratio of the sexes between these and the immigrant moths. In 1934, 55 per cent. of the local generation and 11 per cent. of the immigrants caught at night on fruit were females, while, of those taken from bait, the ratios of males to females were 2 : 3 and 2 : 1, respectively. Some of the first moths to emerge deposited eggs, producing a second generation at the end of May, but within the first week of June all had departed from Njala. The only natural enemy appeared to be *Eumenes maxillosa*, DeG. (*tinctor*, Christ), which filled its nests with the larvae.

As the fruit-piercing moths first appear in numbers about the end of March, when there is little *Citrus* fruit available, they usually feed on cashews and mangos, *Citrus* being attacked later. From July to February, although suitable fruit is present, few moths are to be found, and it is thought that climatic conditions may be responsible. Charts from field records show the numbers of pierced fruits as indicated by pierced windfalls, and the relative abundance of piercing moths weekly in night catches, and daily in poisoned baits. *Citrus* fruits that have been pierced yellow prematurely, generally become infected with fungi and fall after about 2 weeks. The main fall due to puncture occurs in May and June. Experiments on the artificial puncturing of the fruits and the ensuing infection with fungi are described, and a list is given of the main organisms found in oranges, grapefruits and sweet limes. It was evident that infection is not dependent on its introduction by the proboscis of the moths.

In experiments on control, both light-traps and poisoned baits were used, but the former proved valueless, though in some cases the moths, particularly *Achaea* spp., were attracted to the whitened ceilings of houses. The different baits used are described, but a direct comparison of their efficiency is not yet available, as many moths are thought to leave the arsenical baits after feeding and die elsewhere. Demerara sugar was the best attractant, and the most effective bait for *Achaea* was one containing 1·8 gm. sodium arsenite, 160 gm. Demerara sugar and 1,200 cc. water [*cf.* **17** 351 ; **24** 337]. In laboratory tests, moths that were fed on a bait of 1 gm. sodium arsenite, 80 gm. Demerara sugar and 1,200 cc. water, or on one containing 0·8 gm. sodium fluosilicate, 16 gm. Demerara sugar and 120 cc. water, all died within a day or so.

NOTLEY (F. B.). **Differences in the Resistance of the Instars of a Pentatomid Bug to Pyrethrum Powder.**—*Bull. ent. Res.* **27** pt. 4 pp. 607–609, 1 fig., 2 refs. London, December 1936.

An account is given of an experiment that was primarily designed to discover the minimum amount of finely ground pyrethrum powder that would be effective against *Antestia lineaticollis*, Stål, on coffee in Kenya [*cf. R.A.E.*, A **24** 240]. A block of 1,700 coffee trees was divided into 17 square plots, each containing 100 trees. The dust was applied on 9 of the plots, and all the trees in any one plot received the same amount, the rates varying from 1 to 5 gm. per tree. Two days later, 36 trees from the centre of each plot were heavily drenched with a strong kerosene extract of pyrethrum to bring down the surviving *Antestia*. In each of the 8 control plots, 5 trees selected at random were also treated with the extract and the bugs collected, all those from both series of plots being sorted into the different instars and counted. The numbers of adults and 5th, 4th, 3rd, 2nd and 1st instar nymphs calculated to have been present in each individual plot of 36 trees before treatment were 241, 47, 104, 169, 180 and 58, respectively. The percentage mortality of each instar was thus calculated for the 9 experiments. These percentages are expressed in a graph in which the curves for the individual experiments are remarkably constant in shape. The percentage mortalities for all stages together varied from 23 to 96 according to the amount of powder applied, but this variation was largely due to variations in the older stages. The average percentage death rates for adults, and 5th, 4th, 3rd, 2nd and 1st instar nymphs were 52, 17, 54, 83, 92 and 94, respectively, and the minimum percentage for the 1st and 2nd instars was over 80. An additional experiment showed that the anomalous result for the 5th instar was not due to the winged adults having been driven from the treated plots to the controls. In laboratory experiments with pyrethrum powder, the times taken for adults and nymphs of the 5th and 4th instars to become moribund were 468 $\pm$ 83, 508 $\pm$ 154 and 361 $\pm$ 79 seconds, respectively. These figures are not significant, but indicate that the adults are less resistant to pyrethrum than are the 5th instar nymphs.

Owing to the greater susceptibility of the early instars, an application of pyrethrum powder that did not kill the older bugs might cause a break in the overlapping of the generations, thus depleting the supply of eggs available for the important parasites, *Hadronotus antestiae*, Dodd, and *Microphanurus truncativentris*, Dodd. It has been shown, however, that the life of the adult female, during nearly the whole of which it lays eggs at regular intervals, is on the average longer than the duration of all the nymphal instars, so that the parasite population would not die out altogether, even if all the nymphs were killed.

EVANS (J. W.). **A new Species of *Nysius* (Hem. Lygaeidae) from Tasmania, and Notes on the economic Importance of the Genus.**—*Bull. ent. Res.* **27** pt. 4 pp. 673–676, 1 fig., 5 refs. London, December 1936.

A description is given of the Lygaeid, *Nysius turneri*, sp. n., which occurs in numbers on *Cotula coronopifolia* and is apparently confined to an area of reclaimed land near Launceston in Tasmania. During exceptionally dry weather when the swamp vegetation dries up, it

leaves the river margins and migrates to neighbouring gardens, where it causes extensive damage to ornamental plants and vegetable crops.

A list of the 10 species of the genus previously recorded as being of economic importance is compiled from papers abstracted in this *Review*; it includes records of their food-plants and distribution. With all species, outbreaks appear to be associated with abnormally dry summers, but in Australia such climatic conditions are not always accompanied by infestations of *Nysius*. It is suggested that other factors, perhaps biological in nature, determine such fluctuations, and also that abnormally wet winters preceding hot dry summers may be of significance. Control measures include burning or cultural methods for the treatment of breeding sites of limited extent that are adjacent to valuable crops. Smudge fires are of value for driving the insects from fruit crops, and on field crops hopper-dozers have been employed with success. Applications of pyrethrum or calcium cyanide dusts are effective, but the cost is usually considered prohibitive.

Schweig (C.) & Grunberg (A.). **The Problem of Black Scale (*Chrysomphalus ficus*, Ashm.) in Palestine.**—*Bull. ent. Res.* **27** pt. 4 pp. 677–713, 9 figs., 1 pl., 6 refs. London, December 1936.

In a foreword, E. Ballard states that the work described was undertaken owing to the conflicting results of standard fumigation of *Citrus* in Palestine as regards *Chrysomphalus ficus*, Ashm. The results indicate that growers in the Jordan Valley will have to change from summer to winter fumigation, and that in Acre Sub-District, even if the double fumigation now under trial is not practicable, fumigation will have to be completed by the end of July, as otherwise the fruit will be infested.

The climate of the two areas studied is discussed in detail. In the Acre area, which is a broad coastal plain, the average temperature in 1934 was 19·3°C. [66·74°F.], and the relative humidity was very high except during the hot easterly Khamseen winds. In the Jordan Valley in the immediate vicinity of Lake Tiberias, on the other hand, the average temperature was higher (22·8°C. [73·04°F.]) and the relative humidity in the hot season very low.

The adaption of *C. ficus* to its food-plants varies greatly according to the plants themselves and climatic and geographical conditions. A list of the food-plants in Palestine is given. In new areas, 2–3 years of undisturbed activity are necessary for the establishment of infestation. On *Citrus*, infestation is confined to fruit, leaves and young green twigs. In the hot season settling took place on the shady side of the trees, and in the cooler part of the year on the sunny side. Experiments on seedlings at Migdal suffering from lack of water showed that the development of the scale on them stopped after a time, and this was further confirmed by the high mortality rate observed in unwatered groves in Acre or Jaffa. Groves that were over-watered and over-manured had a higher population than those that were neglected.

Spread of the scale is thought to be mainly due to its being carried on seedlings. Importance has been attributed to picked fruits and peels in its dispersal, but in experiments during the fruiting season in Acre, the longest period of survival on peels was 17 days and on picked

fruits 48–70 days. At Migdal, during the summer, the death of full-grown females on picked fruits occurred 3–4 weeks after picking. Oviposition began 30–35 days after picking, but the larvae settled on the fruits and died after the first month, owing to the fruits' decay. The premature ripening of the peel of the picked fruits appeared to act as a stimulus for oviposition and created favourable conditions for the larvae to settle. Experiments on the spread of infestation by means of infested fruit and peels placed under trees, and also by manure and leaves, showed that only the leaves were of importance. Ovipositing females may live for a week or more on fallen leaves, and as these dry up, they are not suitable for the crawlers, which are forced to migrate.

In Acre there were 3–4 generations annually, the number depending on temperature. The spring generation began with eggs laid by females of two kinds, those that had entered the pre-oviposition period before the beginning of the rainy season in December, and those that did so in March. There was a heavy rate of mortality in the spring generation, but this was much reduced in the first summer generation appearing in July, and there was a steady increase in the population continuing throughout the late summer generation, which caused the most damage to both the trees and fruits. The females producing the autumn-winter generation continued to oviposit until and sometimes later than January, but most of them died towards the end of that month. It was shown experimentally that there was no difference in the number of generations on the sunny and the shady side of a tree. A comparison of the life-cycles in Acre and at Migdal showed that the number of generations was higher by 1–2 broods in the warmer Jordan Valley. The secondary importance of humidity was shown by the fact that the higher humidity in Acre did not produce a greater number of broods. The threshold of development and thermal constant [*cf. R.A.E.*, A **23** 296] were estimated as 16·9°C. [62·42°F.] and 535°C. [963°F.] in Acre, and 10·9°C. [51·62°F.] and 816°C. [1468·8°F.] at Migdal. These estimates were based on the spring and summer generations in Acre and on the winter and spring generations at Migdal. Owing to the divergence in dates, no definite conclusions can be drawn, but the discrepancies may perhaps be due to the species at Migdal and Acre being represented by two different thermal races. Experiments in Acre on the acclimatisation of scale from Midgal showed that the first generation needed a rather longer period for the completion of its development, but that the period necessary for the second was the same as that for the Acre scale.

In Acre, when the spring generation began to infest the leaves in April, it also infested the large fruits, which are usually picked in April and May. This brood on fruit did not contribute to the increase of the scale on leaves and was mechanically interrupted by the picking. Migration to newly formed fruits was observed at the end of April or beginning of May, but a separate generation did not then develop. A migration of crawlers of the July brood increased the population on fruit, and the resulting adults ovipositing in August, gave rise to the first of the two generations that develop on fruit. These two late summer and autumn-winter generations infested 80 per cent. or more of the crop and were continually increased in number by migrants from the leaves. The oviposition rate was higher on fruits than on leaves. In October 1934, the Aphelinid parasite, *Aphytis chrysomphali*, Merc., destroyed 70–80 per cent. of all male larvae on fruits, and as a considerable

number of females remained unfertilised, a lowering of the rate of oviposition resulted.

In the Jordan Valley during the summer, the pre-oviposition period of the female lasted approximately as long as all the preceding stages together ; in the winter generation, however, it lasted only 43 days (half March and April) and the entire cycle up to the pre-oviposition period lasted more than 5 months. In this locality, intermittent oviposition occurred throughout the winter, but this was not observed in other parts of Palestine, where a normal diapause occurred. Even under the most favourable conditions, winter reproduction did not increase the scale population, as the larvae perished in enormous numbers owing to adverse weather. Artificial infestations started on seedlings at different times of the year showed that females of the 5th (October) generation at Migdal were potentially the most dangerous, as the percentage mortality was low amongst those that overwintered, that towards the end of March when they began to oviposit they were very prolific, averaging about 160 eggs each, and that most of the crawlers migrating to fruit towards the end of April were their offspring. April and October are therefore the most important months in the annual cycle in the Jordan Valley.

The life-cycle of the individual is discussed in some detail [*cf.* **20** 189]. The total number of eggs laid by one female reached a maximum of 211 at Migdal and 247 in Acre. The incubation period varied from a few hours to about 6 days, according to temperature. The crawlers moved about for 6–8 hours before settling. At this stage, extremes of temperature produced heavy mortality, 25–30°C. [77–86°F.] being favourable, whereas Khamseen winds with temperatures of 40–45°C. [104–113°F.], and the low temperatures of January and February destroyed large numbers. Female larvae moulted twice, the actual process lasting several days in summer and about 30 in winter. It is suggested that they are particularly resistant to fumigation at this stage. Males comprised 40–50 per cent. of the population. Parthenogenetic reproduction did not occur.

Attempts to control *C. ficus* by oil sprays in summer were unsuccessful, as single applications produced a mortality rate of only 60–70 per cent. and the cost was high. Sprays are, however, of some use after fumigation when small centres of re-infestation need immediate treatment. It was evident from fumigation trials at Migdal, however, that with regular fumigation reinfestation should not exceed 5 per cent. of the total crop during the picking season. At the end of the picking season in unfumigated groves, 70–80 per cent. of the fruit was infested. At both Haifa and Migdal, winter fumigation was very effective. Recommendations are given for fumigation treatments in the Jordan Valley and Acre. In the latter district, as the second summer generation is that which establishes the scale in masses on the leaves and strengthens the population on the fruits, treatment should be applied at the critical periods of the life-cycle, that is, the pre-oviposition periods of the summer and autumn generations. Thus two fumigations would have to be carried out annually.

No parasite of the female scales was found, but males in the third instar were attacked by *Aphytis chrysomphali*. Parasitism was low in the Jordan Valley ; in Acre, it was higher in the winter and early spring and low during the summer. As the life-cycle of the parasite is short, occupying only 12–14 days, and its period of maximum activity does not coincide with that of the host, it must be regarded as of only secondary

importance. The larvae of a small Clambid, not yet identified, were found feeding on the eggs of the scale, and the Coccinellid, *Chilocorus bipustulatus*, L., occurred in great numbers in all the *Citrus* belts, both larvae and adults feeding on various Coccids, including *C. ficus*.

SONAN (Jinhaku). **Two new Species of Ichneumon-Flies.**—*Trans. nat. Hist. Soc. Formosa* **26** no. 154 pp. 269–270. Taihoku, July 1936. [Recd. 1937.]

Descriptions are given of *Angitia arisana*, sp. n., reared from *Acanthopsyche* sp. on tea in Formosa, and *Pristomerus taoi*, sp. n., reared from cotton bolls injured by *Earias chromataria*, Wlk., and *Platyedra gossypiella*, Saund., in Kiangsu, China.

CHAMBERLAIN (E. E.). **Turnip-mosaic. A Virus Disease of Crucifers.**—*N. Z. J. Agric.* **53** no. 6 pp. 321–330, 5 figs., 10 refs. Wellington [N. Z.], December 1936.

Turnip mosaic, a virus disease of swedes, turnips and rape, occurs in a number of districts throughout New Zealand. The symptoms are mottling and crinkling of the leaves and stunting of the plants. Infected turnips and, under certain conditions, swedes also become susceptible to a secondary attack by bacterial soft rot. Although not reported to be of economic importance in field crops, the disease has been a serious problem in certain experimental and seed-producing areas. It was transmitted in experiments by the leaf-rubbing method and by Aphids. *Brevicoryne brassicae*, L., transmitted it from swedes to swedes and turnips, and *Myzus persicae*, Sulz., transmitted it from swedes to swedes. *B. brassicae* also transmitted it from swedes to cabbage, cauliflower, Brussels sprouts, and broccoli, which have not been found infected in New Zealand and in which the symptoms caused were slight, and *M. persicae* transmitted it from these plants back to swedes. Attempts to transmit it to tobacco produced conspicuous brown necrotic lesions confined to the points of infection [*cf. R.A.E.*, A **23** 511]. No seed transmission was secured in a small trial involving 432 plants grown from seed of infected swedes. Field observations indicate that some strains of swedes are highly resistant to the infection.

The following recommendations are made for the control of the disease in crops grown for seed : the leaves of the plants should be dipped in a solution of nicotine (1 : 2,000) or nicotine sulphate and soft soap (1 : 4 : 800) to kill insect vectors ; the crop should be inspected regularly and all infected plants removed ; other crucifers should not be grown in the vicinity ; and, when the disease appears, the plants should be sprayed with nicotine or nicotine sulphate at the concentrations used for dipping.

GAUTIER (C.) & BONNAMOUR (S.). **Sur deux *Aphidius* nouveaux du pin (Hym. Braconidae).**—*Bull. Soc. linn. Lyon* N.S. **5** no. 5 pp. 74–75. Lyons, May 1936. [Recd. February 1937.]

Descriptions are given of the Braconids, *Aphidius expectatus*, sp. n., and *A. praevisus*, sp. n., which were reared from small Aphids on pine in the Lyons district.

[Popov (V. I.).] **Попов (В. И.). Corn Borer (*Pyrausta nubilalis* Hb.) as a Corn and Hemp Pest in Bulgaria.** [*In Bulgarian.*]—*Minist. Agric. nat. Domains* [Publ.] no. 68, 103 pp., 15 figs., 1 map, 2 graphs, 88 refs. Sofia, 1936. (With a Summary in English.)

An account is given of the results of observations on *Pyrausta nubilalis*, Hb., in Bulgaria in 1933–35, some of the information being similar to that already noticed [*R.A.E.*, A **19** 147]. Although infestation of maize, which is the principal food-plant, amounted in two districts to over 75 per cent., the damage caused is not of economic importance. More serious loss results from infestation of hemp (*Cannabis sativa*), which in one district amounted to 86 per cent. The author divides Bulgaria into six geographical areas and gives figures for the infestations of maize and hemp observed in a number of localities in 1935. In the north, where *P. nubilalis* has only one complete generation a year, it mainly attacks maize, but in the south and south-west, where it has two, it also seriously infests hemp. Other food-plants are millet (*Panicum miliaceum*), rice, hops, beans (*Phaseolus*), pepper (*Capsicum annum*), *Chenopodium album*, *Amarantus retroflexus* and thistle (*Cirsium arvense*). Observations are described showing that the generation that overwinters in maize stalks in the south oviposits on the leaves of hemp. The resulting larvae bore their way into the stems, causing the tissue to rot owing to the humidity, feed on the stem-walls and nodes, and pupate there during July and August. The adults of this generation oviposit on maize. Thus there are two specialised generations annually in these districts. Eggs were deposited mainly on the underside of leaves of both hemp and maize in clusters of 2–49, averaging 20. In laboratory tests, the total number laid by individual females ranged from 37 to 1,107. Unmated females deposited their eggs in a greater number of clusters.

Observations made on millet showed that of 436 plants, 4·13 per cent. were infested by *P. nubilalis*, and figures are given showing that about half the internodes in infested plants are attacked.

Suggested methods of control include clean cultivation and the destruction of all plant refuse. Maize stalks used for forage should not be kept after 1st May in north Bulgaria or after 1st April in the south. Hemp should be well dried after harvesting to kill any larvae or pupae in it and should be used in the summer in which it is cut. The woodpecker, *Dryobates syriacus balcanicus*, was observed to be predacious on the larvae of *P. nubilalis* in several localities in 1934 and 1935.

Butovitsch (V.). **Studier över tallskottvecklaren, *Evetria buoliana* Schiff. Del I.** [Studies on the Pine Shoot Tortrix, *Rhyacionia buoliana*. Part I.]—*Medd. Skogsförsöksanst.* **29** no. 5 pp. 471–556, 29 figs., 3 pp. refs. Stockholm, 1936. (With a Summary in German.)

Data on the distribution, bionomics and control of *Rhyacionia* (*Evetria*) *buoliana*, Schiff., are reviewed from the literature, and a detailed account is given of studies on it in central and southern Sweden in 1935. It has been recorded from almost all species of pines, but only once from any other conifer [*R.A.E.*, A **19** 640]. In Sweden it occurs from the south coast to Lapland; and in some districts in the south, there is scarcely a plantation or natural regeneration area

that is free from injury by it. Counts in Blekinge (southern Sweden) showed that an average of 33·2 per cent. of the leading shoots were killed.

In an examination of infested shoots on 14th June, 20 pupae and 80 larvae were found, some of the larvae being in the prepupal stage. Bodenheimer [**15** 385] found that *R. buoliana* had two generations a year in Palestine and calculated that the threshold of development is —1°C. [30·2°F.] and that an effective sum of temperatures (thermal constant) of about 3,600°C. [6,480°F.] is necessary for a generation. In Blekinge the effective annual sum of warmth was 2,854·5°C. [5,128·1°F.], and at Uppsala 2,470 [4,446], but there was one generation yearly, so that it is evident that the effective sum of warmth is not the factor governing the duration of development. The course of the growth of the food-plant is of far greater importance, owing to the changes in the food requirements of the larvae during their development. They feed first on the young May needles, then on the buds, and finally on the growing but not woody shoots. This association with the various stages of growth of the pine explains why the duration of development is the same in such different climates as those of southern Italy and central Sweden. Examination of the shoots confirmed the accepted view that oviposition and feeding on the buds occur on the middle shoots in preference to the lateral ones, and in the exposed parts of the tree crown where the biggest buds are to be found. Pines planted in poor soil grow slowly and therefore afford more opportunities to the moth, but stunted, deformed growth is the result of attack and not the reason for it. It was found that neither old trees nor those under 2 years of age had buds and shoots of a size favourable for the development of the larvae. Infestation was markedly greater in areas where the trees were not densely planted, on account of the greater amount of light.

The injury appears to be more severe in the United States than in Europe, evidently owing to lack of natural enemies, but in Blekinge some plantations seem to require re-planting. The pines should be planted close together, all gaps should be re-planted immediately, and no considerable thinning should take place until the trees are about 20 years old. Parasites obtained from 117 pupae of *R. buoliana* were 20 examples of the Ichneumonid, *Pimpla turionellae*, L., and 2 Chalcids, which have not been identified. The larvae of *Adalia* (*Coccinella*) *bipunctata*, L., destroyed most of the eggs in cages.

Appel (O.) Ed. **Pflanzenschutz. Verhütung und Bekämpfung der Pflanzenkrankheiten.** [Plant Protection. The Prevention and Control of Plant Pests and Diseases.]—In Sorauer (P.). *Handb. Pflanzenkr.* 6. Band, 4. Aufl., Lief. 1, pp. 1–288, illus., many refs. Berlin, P. Parey, 1937. Price *Mk.* 12·15. (In Germany and Palestine *Mk.* 16·20.)

This is the first of four parts constituting a sixth volume of Sorauer's text-book [*cf. R.A.E.*, A **20** 48, etc.], which is being issued in view of the attention now given to plant protection and of the development of scientific and technical work devoted to measures for combating pests and diseases of plants. The part under review is divided into sections contributed by various authors and dealing respectively with : the economic importance of plant protection, estimation of losses and cost of measures ; the prevention of plant diseases and

pests by cultural measures, including manuring, seed selection, etc.; soil disinfection; seed disinfection; quarantines; and physical measures for combating pests and diseases. The last section is to be continued in the next part.

Hase (A.). **Neue Beobachtungen über die Männchen und Weibchen der Schlupfwespe** *Nemeritis canescens* **(Hymenoptera : Ichneumonidae).** [New Observations on the Males and Females of *N. canescens*.]—*Arb. morph. taxon. Ent. Berl.* **4** no. 1 pp. 47–61, 3 figs., 3 pp. refs. Berlin, 25th January 1937.

The chief host of *Nemeritis canescens*, Grav., is *Ephestia kuehniella*, Zell., but it has also been recorded in the literature as a parasite of *E. cautella*, Wlk., *E. elutella*, Hb., *Galleria mellonella*, L., *Tinea granella*, L., and *Plodia interpunctella*, Hb. In 1936, the author reared it experimentally on *Achroia grisella*, F., and also observed that when larvae of *A. grisella*, *P. interpunctella* and *E. kuehniella* were available together, the females parasitised all three species with equal readiness. He concludes that *N. canescens* must occur in bee-hives, and that its eagerness for honey is explained by its being a parasite of wax-moths. The literature indicates that males of this Ichneumonid are rare and that reproduction is largely parthenogenetic. The author discusses possible reasons for this, and describes the act of pairing as observed by himself.

Bebbington (A. G.) & Allan (W.). **The Pest and the Plant.**—*Emp. Cott. Gr. Rev.* **14** no. 1 pp. 31–40, 3 figs., 4 refs. London, January 1937.

Commenting on a suggestion that insects and fungi only attack varieties of plants unsuited to their environment, or badly cultivated crops [*R.A.E.*, A **24** 600], the authors discuss their own experience with *Dysdercus* spp. infesting cotton in Northern Rhodesia [**24** 646; **22** 679, etc.] and point out that the attack of these stainers on a cotton plot appears to be determined by two chief factors. Firstly, the actual number of stainers that go to the crop is determined by the state and sequence of the wild food-plants, and cotton should be regarded merely as a potential link in the sequence. Secondly, the distribution of the stainer population over one crop is determined by the state and growth of the plants, but it is the most vigorous, healthy and best fruiting plants that suffer most.

Papers noticed by Title only.

Roark (R. C.). **Research to find Substitutes for Lead Arsenate.** [A review of recent work in the United States.]—*Proc. Conn. pomol. Soc.* **38** pp. 159–165. 1936.

Tattersfield (F.). **Fish-poison Plants as Insecticides, a Review of recent Work.**—*Emp. J. exp. Agric.* **4** no. 14 pp. 136–144, 45 refs. Oxford, April 1936. [Recd. 1937.]

Balachowsky (A.). **Sur un nouveau** *Ripersia* [*parkeri*, sp. n.] **du Midi de la France.**—*Rev. franç. Ent.* **3** fasc. 3 pp. 215–218, 1 pl., 3 refs. Paris, 1936.

Ramakrishna Ayyar (T. V.). **Notes on Coccidae (Homoptera Rhynchota) from South India.**—*J. Bombay nat. Hist. Soc.* **39** no. 1 pp. 146–148, 6 refs. Bombay, December 1936.

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